

AD-A142 565

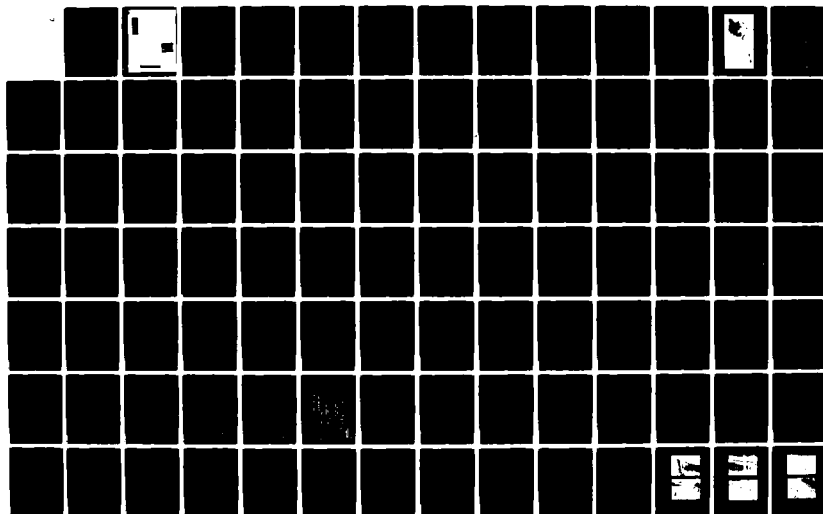
NATIONAL DAM INSPECTION PROGRAM HARTFORD RESERVOIR
NUMBER 6 EAST DAM (CT..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUN 79

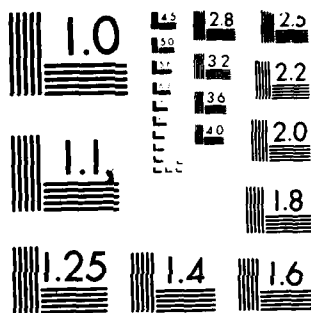
1/2

UNCLASSIFIED

F/G 13/13

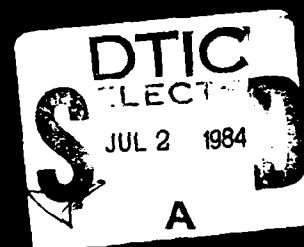
NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

AD-A142 565



84 06 29 057



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

OCT 29 1979

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Hartford Reservoir No. Six Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, the Metropolitan District Commission, Hartford, Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

Max B. Scheider
MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

This document has been approved
for public release and sale; its
distribution is unlimited.



Accession For	
NOTED	
FILED	
INDEXED	
SEARCHED	
SERIALIZED	
FILED	
DATE	
BY	
INITIALS	
REMARKS	
A-1	

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00005, CT 00678, CT 00679	2. GOVT ACCESSION NO. AD-A242 565	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Hartford Reservoir #6 East Dam, Southeast Dam & South Dike, South Dam; -679 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE June 1979
		13. NUMBER OF PAGES 126
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut River Basin Bloomfield Ct. West Hartford Ct.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The three dams are roughly 5050 ft. long and consist of sections of earthen em- bankments separated from each other by areas of natural ground. These sections are the 550 ft. long "South Dam", the 750 ft. long "Southeast Dam" with its app- urtenant 250 ft. lon "South Dike", and the 3500 ft. long "East Dam". The height of the dams varies considerably due to the undulation natural topography, and reaches a maximum of approximately 42 ft. Reportedly, there is a concrete corewall along the entire length of each dam. The spillway, located at the northern-most end of the East Dam, is a 50 ft. long broad-crested concrete weir with 1 ft. high permanent stop planks.		

BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	HARTFORD RESERVOIR NO. 6 EAST DAM
Inventory Number:	CT-00005
Name of Dam:	HARTFORD RESERVOIR NO. 6 SOUTH- EAST DAM AND SOUTH DIKE
Inventory Number:	CT - 00678
Name of Dam:	HARTFORD RESERVOIR NO. 6 SOUTH DAM
Inventory Number:	CT - 00679
State Located:	CONNECTICUT
County Located:	HARTFORD
Towns Located:	BLOOMFIELD AND WEST HARTFORD
Stream:	TRIBUTARY TO TUMBLE BROOK
Owner:	THE METROPOLITAN DISTRICT COMMISSION
Date of Inspection:	APRIL 4, 1979
Inspection Team:	Calvin Goldsmith Peter Heynen, P.E. Theodore Stevens, Gonzalo Castro, P.E. Richard Allen, P.E.

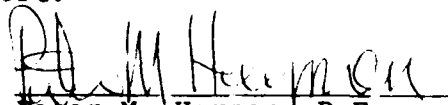
The three dams are roughly 5050 feet long and consist of sections of earthen embankments separated from each other by areas of natural ground. These sections are the 550 foot long "South Dam", the 750 foot long "Southeast Dam" with its appurtenant 250 foot long "South Dike", and the 3500 foot long "East Dam". The height of the dams varies considerably due to the undulating natural topography, and reaches a maximum of approximately 42 feet. Reportedly, there is a concrete corewall along the entire length of each dam. The spillway, located at the northern-most end of the East Dam, is a 50 foot long broad-crested concrete weir with 1 foot high permanent stop planks. The spillway discharges into three 72 inch diameter conduits which empty into the stream channel at a concrete headwall approximately 150 feet downstream from the toe of the dam. Other outlets include a 24 inch tile pipe and a 30 inch reinforced concrete pipe, both located at the south end of the East Dam and both leading to Reservoir No. 5, two 66 inch diameter supply lines from the gatehouse to the filtration plant at the north end of the East Dam, and a 20 inch blowoff pipe also located near the north end of the East Dam.

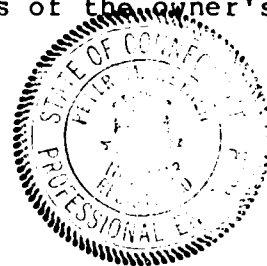
Based upon the visual inspection at the site and past performance, the dams are judged to be in good condition. No evidence of instability was observed in the dams or any of their appurtenant structures. There are some remedial measures which require attention

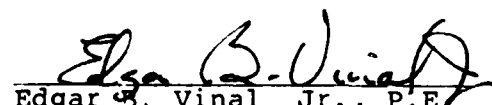
Based upon the size (Intermediate) and the hazard classification (High) of the dams in accordance with Corps of Engineers guidelines, the test flood will be equivalent to the Probable Maximum Flood (PMF). Peak inflow to the reservoir is 4200 cfs; peak outflow is 2280 cfs with the dams maintaining 1.1 feet of freeboard

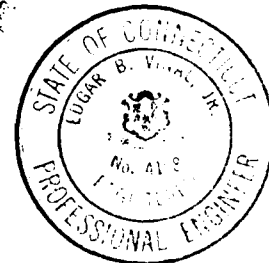
Based upon our hydraulics computations, the spillway capacity is 2560 cfs which is equivalent to 112 percent of the routed test flood outflow.

The remedial or maintenance measures discussed in Section 7 should be implemented within 2 years of the owner's receipt of this report.


Peter M. Heynen, P.E.
Project Manager
Cahn Engineers, Inc




Edgar B. Vinal Jr., P.E.
Senior Vice President
Cahn Engineers, Inc.



This Phase I Inspection Report on Hartford Reservoir No. Six Dams and Dikes has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam would necessarily represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

	<u>Page</u>
Letter of Transmittal	--
Brief Assessment	i,ii
Review Board Signature Page	iii
Preface	iv
Table of Contents	v-vii
Overview Photo	viii
Location Map	Plate No. 1
SECTION 1: PROJECT INFORMATION	
1.1 <u>General</u>	1
a. Authority	
b. Purpose of Inspection Program	
c. Scope of Inspection Program	
1.2 <u>Description of Project</u>	2
a. Location	
b. Description of Dam and Appurtenances	
c. Size Classification	
d. Hazard Classification	
e. Ownership	
f. Operator	
g. Purpose of Dam	
h. Design and Construction History	
i. Normal Operational Procedures	
1.3 <u>Pertinent Data</u>	4
a. Drainage Area	
b. Discharge at Damsite	
c. Elevations	
d. Reservoir	
e. Storage	
f. Reservoir Surface	
g. Dams	
h. Diversion and Regulating Tunnel	
i. Spillway	
j. Regulating Outlets	
SECTION 2: ENGINEERING DATA	
2.1 <u>Design</u>	9

a. Available Data	
b. Design Features	
c. Design Data	
2.2 <u>Construction</u>	9
a. Available Data	
b. Construction Considerations	
2.3 <u>Operations</u>	9
2.4 <u>Evaluation</u>	9
a. Availability	
b. Adequacy	
c. Validity	
SECTION 3: VISUAL INSPECTION	
3.1 <u>Findings</u>	11
a. General	
b. Dams	
c. Appurtenant Structures	
d. Reservoir Area	
e. Downstream Channel	
3.2 <u>Evaluation</u>	15
SECTION 4: OPERATIONAL PROCEDURES	
4.1 <u>Regulating Procedures</u>	16
4.2 <u>Maintenance of Dam</u>	16
4.3 <u>Maintenance of Operating Facilities</u> ..	17
4.4 <u>Description of Any Warning System</u> <u>in Effect</u>	17
4.5 <u>Evaluation</u>	17
SECTION 5: HYDRAULIC/HYDROLOGIC	
5.1 <u>Evaluation of Features</u>	18
a. General	
b. Design Data	
c. Experience Data	
d. Visual Observations	
e. Test Flood Analysis	
f. Dam Failure Analysis	

SECTION 6: STRUCTURAL STABILITY

6.1 <u>Evaluation of Structural Stability...</u>	20
a. Visual Observations	
b. Design and Construction Data	
c. Operating Records	
d. Post Construction Changes	
e. Seismic Stability	

SECTION 7: ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 <u>Dam Assessment</u>	21
a. Condition	
b. Adequacy of Information	
c. Urgency	
d. Need for Additional Information	
7.2 <u>Recommendations</u>	21
7.3 <u>Remedial Measures</u>	21
a. Operation and Maintenance Procedures	
7.4 <u>Alternatives</u>	22

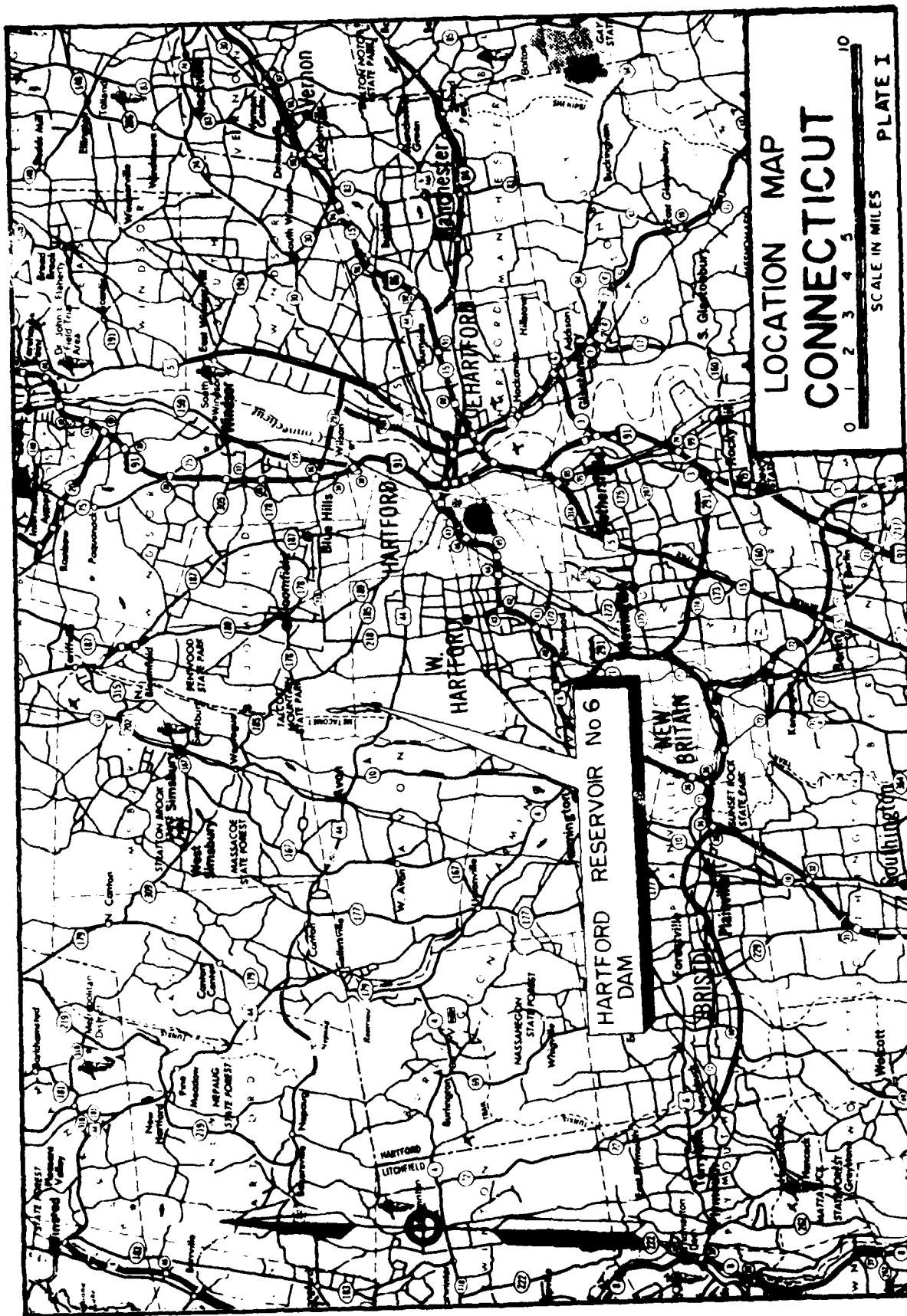
APPENDICES

	<u>Page</u>
Appendix A: Inspection Checklist	A-1 to A-6
Appendix B: Engineering Data and Correspondence	
Dam Plan, Profile and Sections	Plate No. 2
List of Existing Plans	B-1
Summary of Data and Correspondence	B-2, B-3
Data and Correspondence	B-4 to B-46
Appendix C: Detail Photographs	
Photograph Location Plan	Plate No. 2A
Photographs	C-1 to C-6
Appendix D: Hydraulic/Hydrologic Computations	
Drainage Area Map	Plate No. 3
Computations	D-1 to D-18
Preliminary Guidance	i - viii
Appendix E: Information as Contained in the National Inventory of Dams	E-1



OVERVIEW PHOTO
(MARCH, 1979)

US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	HARTFORD RESERVOIR No. 6 DAM TR - TUMBLE BROOK	BLOOMFIELD WEST HARTFORD	DATE June, '79
			CONFIDENTIAL	CE # 27 595 KB PAGE VIII
CAHN ENGINEERS INC. WALLINGFORD, CONN ENGINEER				



PHASE I INSPECTION REPORT
HARTFORD RESERVOIR NUMBER SIX DAMS
SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Cahn Engineers, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Cahn Engineers, Inc. under a letter of November 28, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW 33-79-C-0014 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.
2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.
3. To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

1. Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.
2. A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.
3. Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.
4. An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dams other than on a visual basis. The inspection is to identify those features of the dams which need corrective action and/or further study.

1.2 DESCRIPTION OF PROJECT

a. Location - The dams are located on a tributary to Tumble Brook in a rural area of the towns of Bloomfield and West Hartford, County of Hartford, State of Connecticut. The dams are shown on the Avon U.S.G.S. Quadrangle map having coordinates of latitude N $41^{\circ} 47.7'$ - $41^{\circ} 48.5'$ and longitude W $72^{\circ} 46.9'$. Downstream of the dams are suburban areas of the town of West Hartford.

b. Description Of Dam And Appurtenances - The dams are roughly 5050 feet long and consist of three separate earth embankment dams which are separated from one another by areas of natural high ground (See Appendix B, Plate No. 2). The South Dam is approximately 550 feet long and 14 feet high. The South Dike, which is about 250 feet long and less than 10 feet high, is contiguous with the Southeast Dam which is approximately 750 feet long and 12 feet high. The East Dam, approximately 3500 feet long, varies in height from approximately 40 feet at two locations to only about 6 feet for a portion of its length. There is a gravel roadway along the crest of all of the dams, which have a typical top width of approximately 16 feet. The downstream slopes are covered with grass and, in places, also with heavy brush and/or numerous trees. The downstream slopes have maximum inclinations of approximately 2 horizontal to 1 vertical. Upstream slopes are typically inclined at 3 horizontal to 1 vertical and are protected by handplaced large stone rip-rap up to approximately 4 feet from the crest. The uppermost 2 to 3 feet of the upstream slopes are typically inclined at 2 horizontal to 1 vertical and are grass covered. There is a concrete corewall which the owner assumes to exist along the entire length of the dams, however, no plans were available to accurately define the actual extent of the corewall. The width of the wall, as shown on the two existing sectional plans, varies from 10 feet at its base to 2 feet at its top.

A 50 foot long broad crested concrete spillway with permanent 1 foot stop planks is located at the extreme left (north) end of the East Dam. The spillway discharges into three 72 inch diameter reinforced concrete conduits which empty into a natural stream channel at a concrete headwall approximately 150 feet downstream from the toe of the dam.

c. Size Classification - INTERMEDIATE - The dams impound approximately 3500 acre-feet of water with the reservoir level at the top of the dam, which at elevation 405.4 MSL is approximately 42 feet above the old streambed downstream of the East Dam. According to the Recommended Guidelines, this dam is classified as intermediate in size.

d. Hazard Classification - HIGH - The Reservoir Six Dams are located approximately 1000 to 2000 feet upstream of suburban sections of West Hartford. If a breach of the East Dam were to occur there would be potential for severe loss of life and extensive property damage at the residential developments along Mountain Road near the town line between Bloomfield and West Hartford. The initial impact area for a breach of either the South Dam or the Southeast Dam would be the residential developments along Albany Avenue, west of its intersection with Mountain Road. Other isolated homes, closer to the reservoir, along Ferncliff and Westcliff Drives could be affected by a breach of the Southeast Dam or the right portion of the East Dam (See Appendix D-14).

e. Ownership - The Metropolitan District Commission
Water Bureau
555 Main Street
P. O. Box 800
Hartford, Connecticut 06101
Mr. Peter J. Revill, P.E.
Chief Design Engineer
(203) 278-7850
Mr. Richard B. Allen, P.E.
Purification Engineer
(203) 521-6740

f. Operator - Mr. John Lizzi
Deputy Manager of Plants and Maintenance
The Metropolitan District
(203) 278-7850

g. Purpose of Dam - Water Supply Reservoir

h. Design and Construction History - The following information is believed to be accurate, based upon the available plans and correspondence.

Construction of the original dams was completed in 1895. The dams were unchanged until 1964 at which time they were raised 2 to 3 feet and the crests were graded to a uniform elevation. A paved road, a portion of which is adjacent to the Southeast Dam, was constructed between 1965 and 1971 in order

to provide access to a new filtration plant which was constructed in 1968 immediately to the north of the East Dam. The 1968 work also included construction of a new concrete spillway, spillway conduits, an outlet structure, and a new gatehouse and low level outlets.

i. Normal Operational Procedures - The 24 inch tile conduit and the 30 inch reinforced concrete pipe, located at the right end of the East Dam, normally are at least partially open to supply water to Hartford Reservoir Number Five. From the intake structure, two 66 inch high level intake valves and two 66 inch low level intake valves are operated to regulate the flow to two 66 inch mains supplying water to the filtration plant as needed.

1.3 PERTINENT DATA

a. Drainage Area - 1.9 square miles of rolling terrain. The drainage area is undeveloped and consists of a portion of the eastern slope of a north-south trending basaltic ridge known as Talcott Mountain. Inflow to the reservoir is also received through the "North Talcott Mountain Tunnel", a diversion coming from Barkhamsted and Nepaug Reservoirs and entering the northern end of Reservoir Six from the west side. The diversion can be controlled, and is normally closed during periods of heavy precipitation.

b. Discharge At Damsite - Discharge at the damsite is from over the spillway and into three 72-inch reinforced concrete pipes; through two 66 inch supply mains to the filtration plant; through a 20-inch blowoff pipe; and through a 24-inch tile pipe and a 30-inch reinforced concrete pipe both feeding Reservoir Five. All are on the East Dam.

1. Outlet Works (conduits):

Two 66 inch supply mains @ Invert Elevation:	380.6
Two 66 inch high level intakes to supply mains @ Invert Elevation:	387.9
One 30 inch reinforced concrete low level outlet pipe @ Invert Elevation:	370.9
One 20 inch blowoff pipe @ Invert Elevation:	360.9

- | | |
|--|--|
| 2. Maximum known flood at
damsite: | Not determined for
present dams. During
August 18, 1955 flood,
water was 2.5 feet over
weir with 2 feet of
freeboard remaining. |
| 3. Ungated spillway
capacity @ top of dam
elevation 405.4: | 2560 cfs. |
| 4. Ungated spillway
capacity @ test flood
elevation 404.3: | 2280 cfs. |
| 5. Gated spillway capacity
@ normal pool elevation: | N/A |
| 6. Gated spillway capacity
@ test flood elevation: | N/A |
| 7. Total spillway capacity
@ test flood elevation
404.3: | 2280 cfs |
| 8. Total project discharge
@ test flood elevation
404.3: | 2280 cfs. |
| c. <u>Elevations</u> (Feet above Mean Sea Level) | |
| 1. Streambed at left end
of East Dam: | 364 ₊ |
| 2. Maximum tailwater: | N/A |
| 3. Upstream portal invert
diversion tunnel: | 398.5 ₊ |
| 4. Recreation pool: | N/A |
| 5. Full flood control
pool: | N/A |
| 6. Spillway crest (stop planks): | 398.5 |
| 7. Design surcharge
(original design): | 404.9 |

- | | |
|---------------------------------|-------|
| 8. Top of dams: | 405.4 |
| 9. Test flood design surcharge: | 404.3 |
- d. Reservoir
- | | |
|----------------------------------|-----------|
| 1. Length of maximum pool: | 8400+ ft. |
| 2. Length of recreational pool: | N/A |
| 3. Length of flood control pool: | N/A |
- e. Storage
- | | |
|-------------------------|-----------------|
| 1. Recreation pool: | N/A |
| 2. Flood control pool: | N/A |
| 3. Spillway crest pool: | 2480 acre - ft. |
| 4. Top of dams: | 3500 acre - ft. |
| 5. Test flood pool: | 3350+ acre- ft. |
- f. Reservoir Surface
- | | |
|---|------------|
| 1. Recreation pool: | N/A |
| 2. Flood control pool: | N/A |
| 3. Spillway crest
(with 1' stop planks): | 141 acres |
| 4. Test flood pool: | 165+ acres |
| 5. Top of dams: | 165 acres |
- g. Dams
- | | |
|---------------|--|
| 1. Type: | Earth embankment with concrete corewall. |
| 2. Length: | 3500 ft. - East Dam
1000 ft. - Southeast Dam
and South Dike
550 ft. - South Dam |
| 3. Height: | 42 ft. (Max.) |
| 4. Top width: | 16 ft. (Typical) |

- | | |
|---------------------|--|
| 5. Side slopes: | 3 H to 1 V Upstream
2 H to 1 V Downstream |
| 6. Zoning: | N/A |
| 7. Impervious Core: | Concrete core assumed
by owner to exist for
entire length of embank-
ments. |
| 8. Cutoff: | N/A |
| 9. Grout curtain: | None |
| 10. Other: | N/A |
- h. Diversion and Regulating Tunnel
- | | |
|---------------------------|---|
| 1. Type: | Tunnel through mountain.
Approximately 7'x6'.
Diversion from Nepaug &
Barkhamsted Res. |
| 2. Length: | 1 mile (Approx.) |
| 3. Closure: | N/A |
| 4. Access: | At each end of tunnel. |
| 5. Regulating Facilities: | Diversion may be regu-
lated at several valves
along its route |
- i. Spillway
- | | |
|----------------------|--|
| 1. Type: | Low broad crested con-
crete weir with per-
manent one-foot stop
planks |
| 2. Length of weir: | 50 ft. |
| 3. Crest elevation: | 398.5 (includes 1'
stop planks) |
| 4. Gates: | None |
| 5. Upstream Channel: | Nearly horizontal, shallow
for 75+ feet |

7. General:

Effective capacity controlled by three 72" conduits' capacity.

j. Regulating Outlets(East Dam)

1. Invert:

Elev. 380.6 (2 supply mains)

2. Size:

66" dia.

3. Description:

Sluice gates

4. Control Mechanism:

Electric with manual back-up system.

5. Other:

30" RCP from reservoir
to: 1) stilling well to
24" tile
2) 30" pressurized
RCP

24" tile and 30" RCP then
go to Hartford Reservoir
No. 5

20" C.I. blowoff

SECTION 2: ENGINEERING DATA

2.1 DESIGN DATA

a. Available Data - The available data provided by the owner consists of drawings by Metropolitan District Commission Engineers for the original dam construction, for the 1964 improvements, for the 1968 filtration plant, spillway and gatehouse construction, for construction of the paved access road and toe drains adjacent to the Southeast Dam; and a large scale color topographic map of the reservoir, dams and immediate vicinity. The owner also provided hydrologic design data and inspection reports.

b. Design Features - The available data indicates the design features stated previously herein.

c. Design Data - The only engineering values, test results or calculations available for construction are hydrologic/hydraulic computations for the design of the 1964 raising of the dam embankments and the subsequent spillway reconstruction, as performed by Metropolitan District Commission Engineers (See Appendix B).

2.2 CONSTRUCTION

a. Available Data - Although the dams appear to have been built according to the proposed plans, none of the plans have been noted "as-built" drawings. However, the proposed plans for the 1964 raising of the dams do depict actual configurations of the embankments prior to these 1964 improvements. Also, the 1"=200' topographic map of the reservoir area was compiled from photogrammetric surveys dated 1957 and April, 1978 done for the Metropolitan District Commission.

b. Construction Considerations - No information was available.

2.3 OPERATIONS

Lake level readings are recorded daily. The spillway capacity has apparently never been exceeded according to available records.

2.4 EVALUATION

a. Availability - Existing data was provided by the owner, who also made the facility available for inspection.

b. Adequacy - The limited amount of as-built engineering data was generally inadequate to perform an in-depth assessment of the dams, therefore, the final assessment of these dams must be based primarily on visual inspection, performance history, hydraulics computations of spillway capacity and approximate hydrologic judgments.

c. Validity - A comparison of record data and visual observations reveals no observable significant discrepancies in the record data.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General - The general condition of the dams is good. Inspection did reveal some areas requiring maintenance.

b. Dams - The reservoir level was just above the top of the stop planks at the time of our field inspection.

1) East Dam

Crest - The crest has a typical width of approximately 16 feet and is used extensively as a walkway and jogging path. As such, it is covered with sand and gravel for nearly its entire length (Photo 3). The crest is paved at the left (north) end of the dam for a distance of 600 feet to provide an access road for the gatehouse (Photo 8). The crest is consistently in good condition along both the sand and gravel, and the paved portions. It appears to be at a uniform elevation with no signs of problem erosion, settlement, movement or cracking.

Upstream Slope - The upstream slopes of the separate dams are similar in construction, apparently having all been raised in a similar manner during 1964 (Photo 3). The lower portions of the slopes are paved with large hand placed riprap and generally are inclined at 3 horizontal to 1 vertical in the steepest portions. From the top of the riprap to the gravel walkway along the crest, the upstream slope is grass covered and continues at a 3 to 1 slope to about 2 to 3 feet from the crest. The top 2 to 3 feet of the embankments were added in 1964 and have upstream slope inclinations of approximately 2 horizontal to 1 vertical. The upstream slopes appear to be in good condition with only minor losses of riprap where large pieces of red sandstone have been severely weathered and eroded (Photo 4).

Downstream Slope - The downstream slope is generally inclined at 2 horizontal to 1 vertical, although this appears to vary from place to place along the dam.

Much of the downstream slope of the East Dam is grass covered, however, there are many trees, mostly cedars, growing on the slope with many of these being towards the top of the slope (Photo 7). Upon inspection, it was seen that while trees near the toe of slope were cut down, those closer to the crest were left standing. Numerous trees have been uprooted all along the dam causing minor cavities on the slope (Photo 6).

Towards the left (north) end of the East Dam, the downstream slope is covered with very thick brush and at the extreme left end where the slope steepens slightly, shrubs have been planted to control erosion (Photo 8). A gravel road running along a major portion of the toe of the dam has been cut into the slope very slightly causing an approximately 12 inch drop off at the toe (Photo 5). The road follows the original undulating topography and at one high point in the road a soggy area was observed (see Plate No. 2), indicating the possible presence of minor seepage in the area (Photo 10). There are two areas at the downstream toe of the dam which appear to have been excavated for material for construction of either the dam or the access road embankment. At two places along the downstream slope of the East Dam, footpaths going up the slope have caused some erosion (Photo 5). Scattered animal burrows were observed on the downstream slope, particularly near the right end of the dam.

Spillway - The 50 foot long spillway is a broadcrested concrete weir with 12 inch permanent stop planks inserted into slots in the concrete training walls and fixed atop the spillway by means of 7 iron brackets along the downstream side of the planks. The approach channel is shallow, has a rocky and sandy bottom and appears to have been blasted out of the southern tip of a small basaltic ridge. The left spillway training wall appears to be keyed into the resultant rock outcrop. All of the concrete appears to be in excellent condition (Photo 11). The spillway empties into three 72 inch diameter reinforced concrete conduits which run underground for a distance of approximately 730 feet in a wide curve to the right and subsequently empty into a stilling basin approximately 150 feet downstream of the dam (Photo 12). The stilling basin is upstream of a riprap-lined steep-sided channel which leads to the natural streambed. Movement of about one inch was observed on the right stilling basin retaining wall, however the stilling basin headwall and training walls are generally in excellent condition as are 5 smaller headwalls which empty storm drainage and filtration plant drainage into the same stream channel.

2) Southeast Dam and South Dike

Crest - The crest is similar in configuration to that of the East Dam, with the exception of the extreme right (south) end of the Southeast Dam, where the paved access road passes along the crest for a distance of 150 feet. The crest appears to be in good condition with no problems evident.

Upstream Slope - The upstream slopes are in good condition, having been constructed as described previously for the East Dam. For the majority of the time, the water surface elevation of the reservoir is below the upstream toe of the South Dike.

Downstream Slope - The downstream slopes of the Southeast Dam and the South Dike are similar to that of the East Dam in configuration. The South Dike is grassed on the downstream slope and there are some very large trees growing near the toe of the slope. The access road embankment has been built alongside of and adjacent to the Southeast Dam, the downstream slope of the roadway embankment, in effect, becoming the downstream slope of the dam. This slope is sparsely vegetated with brush and there is a wet, marshy area at its toe.

3) South Dam

Crest - The crest is similar to that of the East Dam, and was observed to be in good condition. (Photo 1).

Upstream Slope - The upstream slope is similar to the upstream slope of the East Dam, described previously in this section. There were areas observed where riprap was missing or where sandstone riprap had deteriorated.

Downstream Slope - The downstream slope of the South Dam is sloped at 2 horizontal to 1 vertical, is grassed, with some small saplings starting to grow from stumps of small trees and brush which appear to have been cut down fairly recently. Scattered animal burrows were observed on the downstream slope of the South Dam, which, perhaps because of its sunny southern exposure, is a favorite area for burrowing animals.

There is a wet area approximately 125 feet long and 60 feet wide across the toe of the South Dam (Photo 2). This wet area is confined in a low lying area by the dam upstream and the access road embankment downstream. This appears to be a natural wet condition which has probably been caused by poor drainage.

c. Appurtenant Structures - A gatehouse of concrete, brick and steel girder construction is located on the East Dam approximately 400 feet to the right of the spillway (Photo 8). The structure houses two 7'x7' high level sluice gates and two 7'x7' low level sluice gates which regulate intake to two 66 inch supply mains to the filtration plant. At the time of our inspection the left high level intake valve was inoperable and stuck in closed position, however, it was scheduled to be repaired shortly.

A 48 inch reinforced concrete blowoff pipe empties directly into the spillway discharge channel approximately 250 feet downstream of the main headwall. The pipe, which is fed by a 20 inch pipe, appears to be in good condition, however, its outlet is obstructed by a small tree which has grown in the wet area (Photo 9). The valve control for the blowoff is located at the toe of the dam approximately 800 feet to the right of the spillway.

At the toe of the extreme right end of the East Dam is a stilling well which serves to relieve pressure on a 24 inch tile conduit running to Reservoir Number Five. A 30 inch reinforced concrete pipe located in the same area runs under pressure to Reservoir Number Five. Both lines to Reservoir Number Five are fed by a 30 inch reinforced concrete pipe through the dam and are controlled by valves located at or near the stilling well at the toe of the dam.

All of the outlet works appeared to be well maintained and in good condition at the time of our inspection. All, with the exception of the left high level intake at the gatehouse, were reportedly operable at the time of our inspection.

The construction of the paved access road adjacent to the downstream slope of the Southeast Dam was such that a drainage ditch closed at both ends was formed between the roadway embankment and the dam. To preclude the possibility of drainage problems, a drop inlet was installed at the lowest point in the ditch and a gravel subdrain and a 6 inch perforated corrugated metal pipe installed for the length of the ditch. An 18 inch reinforced concrete culvert pipe from the drop inlet and ten 6 inch corrugated metal pipes from the subdrain discharge into the marshy area east (downstream) of the access road. On visual inspection, this drainage system appeared to be functioning properly, although no flow was observed from the 6 inch pipes.

d. Reservoir Area - There are few anticipated changes in runoff potential as the entire watershed is heavily wooded and there is little likelihood of upstream developments in the near future. For this reason, there are no potential upstream hazard areas.

e. Downstream Channel - The channel immediately downstream of the headwall is lined with dumped riprap for approximately 200 feet. The stream then passes through a wooded area in its naturally well confined channel for about 750 feet before entering a small pond.

3.2 EVALUATION

Based upon the visual inspection, it was possible to assess the dam as being generally in good condition. The following features which could influence the future condition and/or stability of the dam were identified.

1. The roots of the trees, primarily the larger deciduous trees, growing on the downstream slope of the East Dam could, in the future, provide seepage paths through the dam. Uprooting of these trees could also damage the dam, especially near the crest.
2. The animal burrows on the various downstream slopes could conceivably provide seepage paths through the dam.
3. Erosion along foot paths and near uprooted trees on the downstream slope of the East Dam could increase and eventually lead to a deterioration of the slope.
4. Any further cutting of the dirt road into the toe of the East Dam could cause sloughing and erosion of the toe.
5. The slightly soggy area in the dirt road at the toe of the East Dam could be evidence of seepage.
6. Riprap missing at the few isolated areas of the upstream slopes could lead to slope erosion.
7. The control valves for the 20 inch blowoff and 30 inch intake to the supply lines to Reservoir Number Five are positioned at the downstream toe of the East Dam, causing the pipes through the dam to be under a constant head of water when the valves are in a closed position.

SECTION 4: OPERATIONAL PROCEDURES

4.1 REGULATING PROCEDURES

Inflow to the reservoir is primarily through the North Talcott Mountain Tunnel diversion from the Barkhamsted and Nepaug Reservoirs. The diversion is normally closed off at one or more of its several shutoff points during periods of heavy precipitation or extensive snowmelt.

There are four 7'x7' intakes to the screen chamber which feed two 66 inch supply mains to the filtration plant. The valves for the intakes and for the supply mains are operated in conjunction with each other. A 60 inch cross connecting line and valve links the 2 supply mains which supply water to the filtration plants as demanded. The valve stem for the left upper intake was broken and the gate was stuck in a closed position at the time of our inspection.

Valves for the 24 inch tile and 30 inch reinforced concrete lines to Reservoir Five are located at or near the stilling well immediately downstream at the right end of the East Dam, and may be operated by remote control. The valves are normally at least partially open in order to supply Reservoir Five which is a "balancing" reservoir. The stilling well, which relieves pressure on the gravity feed tile line, was last inspected and repaired by scuba-divers sometime in the mid 1960's.

Lake level readings are taken daily. The reservoir level is well regulated and the operators need to do little to maintain the water level at any constant elevation.

4.2 MAINTENANCE OF DAM

Ground crews, who are responsible for several of the Metropolitan District Commission Reservoirs, perform maintenance such as cutting grass, brush and trees on a routine basis. In 1973, the owner implemented a five year inspection program which has yielded 2 inspections thus far. Engineers perform an in-depth visual inspection of the embankments, pipelines and appurtenances and write a formal report containing recommendations for public safety, aesthetics and correction of any problems.

4.3 MAINTENANCE OF OPERATING FACILITIES

Facilities are maintained as necessary when they are operated.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

No formal warning system is in effect. The owner would be in contact with the local Police and Civil Defense Authorities if a possible emergency situation were to arise.

4.5 EVALUATION

Operating and maintenance procedures at the dams are very good and all facilities appeared to be very clean and in good working condition at the time of our inspection with the exception of the left high level intake valve, which was scheduled to be repaired. A formal warning system should be developed and implemented within the time-frame indicated in Section 7.1c. Remedial operation and maintenance recommendations are presented in Section 7.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. General - This reservoir is basically a storage and supply reservoir utilized to augment water supplies at downstream reservoirs as well as to supply water to the filtration plant immediately downstream of the left (north) end of the East Dam. The reservoir has a large amount of storage for a relatively small drainage area. A diversion tunnel into the reservoir from the Nepaug and Barkhamsted Reservoirs is gated and can be stopped if needed. The hydraulic/hydrologic computations performed for this report were made assuming the diversion tunnels to be closed off.

b. Design Data - No hydraulics computations could be found for the original dam design. There are extensive hydrologic/hydraulic evaluations of design storms, emergency storms, reservoir and spillway capacities, flood routing, and recommendations and criteria for hydrologic improvements, all of which were used in the design of the 1964 raising of the dams, and are included in Appendix B.

c. Experience Data - No information on serious problem situations arising at the dams was found, and it does not appear that the dams have ever been overtopped.

d. Visual Observations - The spillway and discharge channels downstream of the three 72 inch outlets both are clear and unobstructed. There is a small tree obstructing the blowoff pipe outlet channel which leads to the downstream discharge channel.

e. Test Flood Analysis - The test flood for the high hazard intermediate size East Dam is equivalent to the Probable Maximum Flood (PMF). Based upon "Preliminary Guidance for Estimating Maximum Probable Discharges", dated March, 1978, peak inflow to the reservoir is 4200 cfs (Appendix D-3); peak outflow is 2280 cfs with the dams maintaining a freeboard of approximately 1.1 feet (Appendix D-13). Based upon our hydraulics computations, the spillway and conduit capacity is 2560 cfs, which is approximately 112 percent of the routed Test Flood outflow at the top of dam, elevation 405.4.

f. Dam Failure Analysis - Utilizing the April, 1978, "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", the peak failure outflow from a breach of the East Dam would be 89,500 cfs. A breach of the left portion of

the East Dam would result in a rise on the order of 11.5 feet in the water level of the stream at the initial impact area, which corresponds to an increase in the water level from approximately 4.4 feet just before the breach to approximately 15.9 feet just after the breach. The rapid rise in the water level would endanger 10 to 20 residences in an urbanized section of West Hartford approximately 4000 feet downstream of the dam in the initial impact area (Appendix D-18).

In addition to the initial impact area analyzed, there are two other impact areas which could have been considered as the initial impact areas; these are 1) downstream of the Southeast Dam and the right portion of the East Dam, and 2) downstream of the Southeast Dam and the South Dam (Appendix D-14, 15).

The impact area downstream of the East Dam was analyzed because it has as great or a greater hazard/damage potential as the other two areas and was therefore taken as representative of the hazard potential of Hartford Reservoir Number Six.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - There was no evidence of instability in any of the earth embankment dams or in the intake or outlet structures.

b. Design and Construction Data - There is not enough detailed design or construction data for the original dam construction to permit an in-depth assessment of the structural stability of these dams.

c. Operating Records - The operating records do not include any indication of dam instability since its construction in 1895.

d. Post Construction Changes - The two to three foot raising of the dams in 1964 did not have any apparent adverse effect on their stability. The addition of the roadway embankment adjacent to the downstream face of the Southeast Dam between 1965 and 1971 substantially increased the stability of the dam. The 1968 construction of the concrete spillways, conduits, gate and screen house, and outlet structures appears to be quite stable and has apparently had no adverse effect on the dam.

e. Seismic Stability - The dams are in Seismic Zone 1 and, according to the Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7: ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition - Based upon the visual inspection of the site and its past performance, the dams appear to be in good condition. No evidence of structural instability was observed in the dam. The embankment is generally in good condition with areas of only minor concern, such as trees, animal burrows and minor amounts of erosion on the downstream slope.

b. Adequacy of Information - The information available is such that an assessment of the condition and stability of the dams must be based solely on visual inspection, the past performance of the dams, and sound engineering judgment.

c. Urgency - It is recommended that the measures presented in section 7.3 be implemented within 2 years of the owner's receipt of this report.

d. Need For Additional Information - This study has not identified a need for additional investigations.

7.2 RECOMMENDATIONS - There are no recommendations aside from the remedial measures presented in Section 7.3

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures - The following measures should be undertaken by the owner within the time frame indicated in Section 7.1c and continued on a regular basis.

1. Round-the-clock surveillance should be provided during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of an emergency.
2. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.
3. The areas of erosion on the downstream slope due to footpaths should be reseeded and protected against further trespassing.
4. The animal burrows on the downstream slope should be filled in as should any subsequent burrows.

5. Any trees and associated root systems with trunk diameters greater than 5 inches growing on the downstream slopes should be removed. Any uprooted trees and tree stumps should also be removed and the resultant cavities filled in, regraded and reseeded. The removal program should be gradual to insure that slope protection can be established with little or no erosion occurring in the interim period.
6. The frequency of technical inspection by the owner's engineers should be increased from every five years to every two years, and should include items mentioned in this report.
7. Riprap should be replaced in the isolated areas of the upstream slope where it is missing. Replacement riprap should be a basaltic rock rather than the easily erodable sandstone.
8. The slightly soggy area in the dirt road at the toe of the East Dam should be checked periodically for evidence of increasing seepage.
9. Valves for the blowoff and for the 30 inch intake for the two lines to Reservoir Five should be moved to the upstream side of the East Dam to relieve pressure on these pipes through the dam, which, when closed off, are under a constant head of water.
10. The tree blocking the 48 inch blowoff outlet pipe downstream of the East Dam should be removed.

7.4 ALTERNATIVES

This study has identified no practical alternatives to the above remedial measures.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT HARTFORD RESERVOIR NO. 6

DATE: 4/4/74

TIME: 12:00 NOON

WEATHER: OVERCAST 55°

W.S. ELEV. 400.7± U.S. DN.S
(MDD)

PARTY:

INITIALS:

DISCIPLINE:

1. <u>CALVIN GOLDSMITH</u>	<u>CG</u>	<u>CAHN ENGINEERS, INC.</u>
2. <u>THEODORE STEVENS</u>	<u>TS</u>	<u>CAHN ENGINEERS, INC.</u>
3. <u>PETER HEYEN</u>	<u>PH</u>	<u>CAHN ENGINEERS, INC.</u>
4. <u>GONZALO CASTRO</u>	<u>GC</u>	<u>GEOTECHNICAL ENGINEERS, INC.</u>
5. <u>RICHARD ALLEN</u>	<u>OWNER'S REPRESENTATIVE (MDC)</u>	
6. <u> </u>	<u> </u>	<u> </u>

PROJECT FEATURE

INSPECTED BY

REMARKS

1. <u>SOUTH DAM EMBANKMENT</u>	<u>CG, TS, PH, GC</u>
2. <u>SOUTHEAST DAM / SOUTH DIKE EMBANKMENT</u>	<u>CG, TS, PH, GC</u>
3. <u>EAST DAM EMBANKMENT</u>	<u>CG, TS, PH, GC</u>
4. <u>GATEHOUSE</u>	<u>CG, TS, PH, GC</u>
5. <u>SPILLWAY</u>	<u>CG, TS, PH, GC</u>
6. <u> </u>	<u> </u>
7. <u> </u>	<u> </u>
8. <u> </u>	<u> </u>
9. <u> </u>	<u> </u>
10. <u> </u>	<u> </u>
11. <u> </u>	<u> </u>
12. <u> </u>	<u> </u>

PERIODIC INSPECTION CHECK LIST

Page A-2

PROJECT HTFD. RES. 6 DAM

DATE 4/4/79

PROJECT FEATURE SOUTH DAM EMBANKMENT BY CG, TS, PH, GC

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	407.5 MDD
Current Pool Elevation	400.7 ± MDD
Maximum Impoundment to Date	N/A
Surface Cracks	NONE OBSERVED
Pavement Condition	N/A
Movement or Settlement of Crest	NONE OBSERVED
Lateral Movement	} TOO IRREGULAR TO JUDGE
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	GOOD
Indications of Movement of Structural Items on Slopes	N/A
Trespassing on Slopes	NONE OBSERVED - GRAVEL WALKWAY ALONG CREST
Sloughing or Erosion of Slopes or Abutments	ANIMAL BURROWS
Rock Slope Protection-Riprap Failures	MINOR RIPRAP DISPLACEMENT
Unusual Movement or Cracking at or Near Toes	NONE OBSERVED
Unusual Embankment or Downstream Seepage	NONE OBSERVED - WET AREA @ TOE
Piping or Boils	NONE OBSERVED
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	N/A

PERIODIC INSPECTION CHECK LIST

Page A-3PROJECT HTFD. RES. 6DATE 4/4/79PROJECT FEATURE SOUTHEAST DAM / SOUTH DIKE BY CG, TS, PH, BC

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	407.5 MDD
Current Pool Elevation	400.75 MDD
Maximum Impoundment to Date	N/A
Surface Cracks	NONE OBSERVED
Pavement Condition	GOOD
Movement or Settlement of Crest	NONE OBSERVED
Lateral Movement	} TOO IRREGULAR TO JUDGE
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	GOOD
Indications of Movement of Structural Items on Slopes	N/A
Trespassing on Slopes	NONE OBSERVED
Sloughing or Erosion of Slopes or Abutments	NONE OBSERVED
Rock Slope Protection-Riprap Failures	MINOR RIPRAP DISPLACEMENT
Unusual Movement or Cracking at or Near Toes	NONE OBSERVED
Unusual Embankment or Downstream Seepage	NONE OBSERVED
Piping or Boils	NONE OBSERVED
Foundation Drainage Features	DITCH W/ CB BETWEEN DAM & ACCESS ROAD EMBANKMENT
Toe Drains	YES - APPEARS TO BE FUNCTIONAL
Instrumentation System	N/A

A-3

PERIODIC INSPECTION CHECK LIST

Page A-4

PROJECT HTFD. RES. NO. 6

DATE 4/4/79

PROJECT FEATURE EAST DAM EMBANKMENT BY CG, IS, PH, GC

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	407.5 MDD
Current Pool Elevation	400.7 ± MDD
Maximum Impoundment to Date	N/A
Surface Cracks	NONE OBSERVED
Pavement Condition	N/A
Movement or Settlement of Crest	NONE OBSERVED
Lateral Movement	} TOO IRREGULAR TO JUDGE
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	GOOD
Indications of Movement of Structural Items on Slopes	N/A
Trespassing on Slopes	TWO FOOTPATH ON D/S SLOPE
Sloughing or Erosion of Slopes or Abutments	ANIMAL BURROWS, UPROOTED TREES
Rock Slope Protection-Riprap Failures	MINOR DISPLACEMENT OF RIPRAP
Unusual Movement or Cracking at or Near Toes	NONE OBSERVED
Unusual Embankment or Downstream Seepage	NONE OBSERVED
Piping or Boils	NONE OBSERVED
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	N/A

Page A-5

DATE 4/4/79

BY CG, TX, PH, BC

A-5

PERIODIC INSPECTION CHECK LIST

Page A-6

PROJECT HTFD RES. NO. 6

DATE 4/4/79

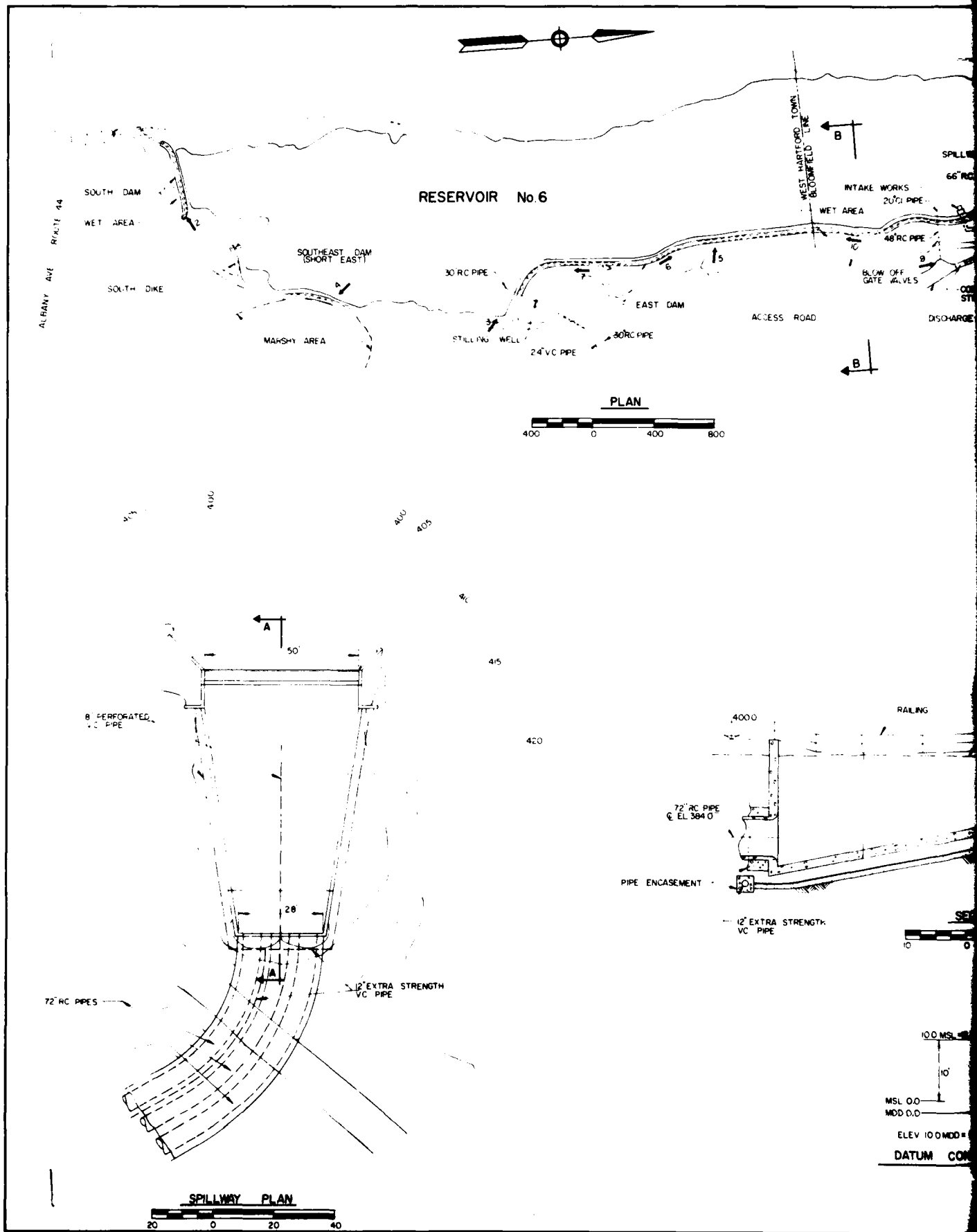
PROJECT FEATURE SPILLWAY

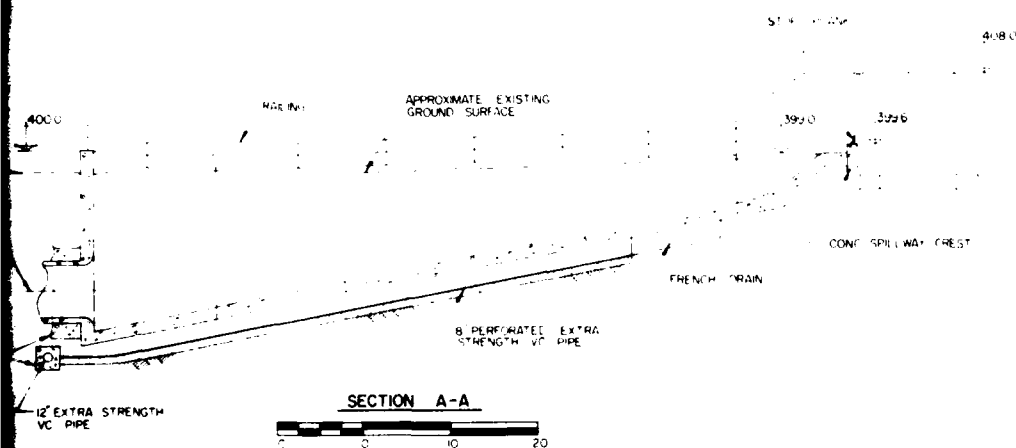
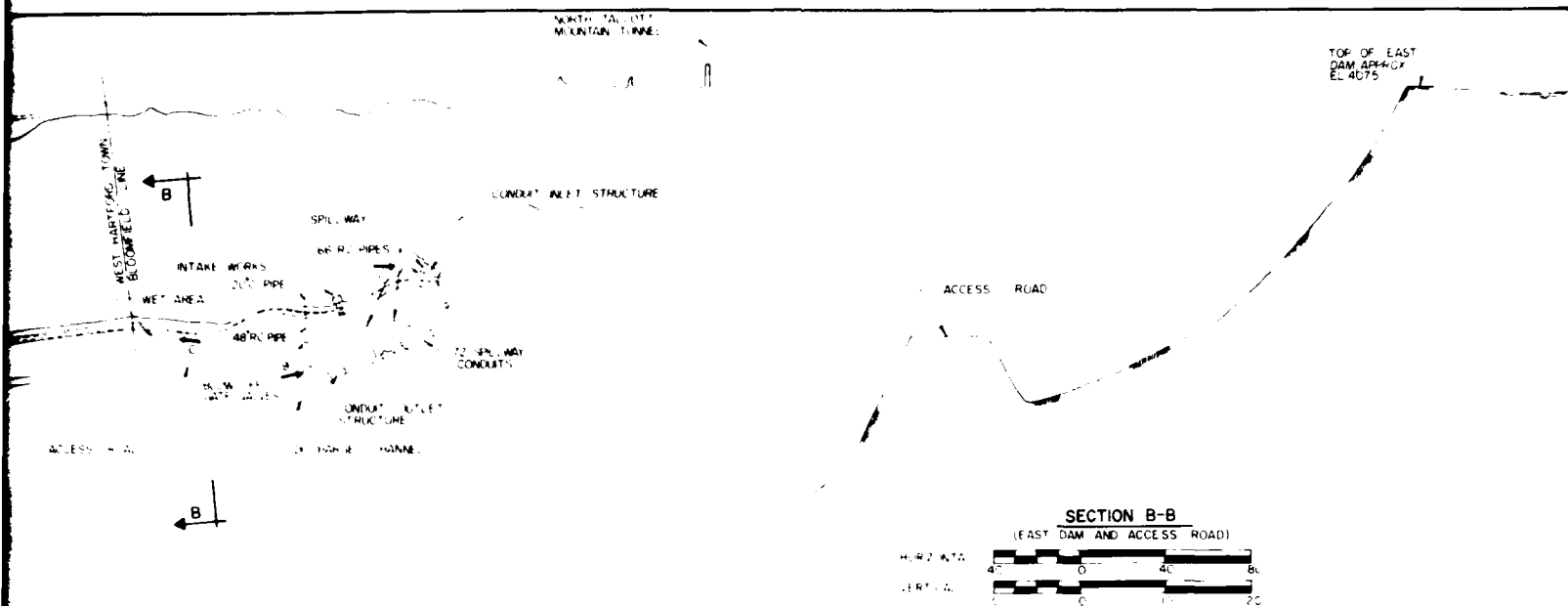
BY CG, TS, PH, GL

AREA EVALUATED	CONDITION
<u>OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a) <u>Approach Channel</u>	
General Condition	SHALLOW ROCKY, PROBABLY BLASTED OUT OF RIDGE
Loose Rock Overhanging Channel	NONE OBSERVED
Trees Overhanging Channel	NONE OBSERVED
Floor of Approach Channel	ROCKY
b) <u>Weir and Training Walls</u>	
General Condition of Concrete	GOOD
Rust or Staining	NONE OBSERVED
Spalling	NONE OBSERVED
Any Visible Reinforcing	NONE OBSERVED
Any Seepage or Efflorescence	NONE OBSERVED
Drain Holes	NONE OBSERVED
c) <u>Discharge Channel</u>	
General Condition	THREE 72' CONDUITS TO STREAM CHANNEL
Loose Rock Overhanging Channel	GOOD
Trees Overhanging Channel	NONE OBSERVED
Floor of Channel	NONE OBSERVED
Other Obstructions	RIPRAP
	N/A

APPENDIX B

ENGINEERING DATA AND CORRESPONDENCE





NOTES:

1 THIS PLAN WAS COMPILED FROM A GENERAL PLAN OF THE DAM ON A SHEET ENTITLED "RESERVOIR NO. 6 FILTRATION PLANT, ACCESS ROAD, PAVING AND APPURTENANCES, GENERAL AND LOCALITY PLANS" BY THE METROPOLITAN DISTRICT WATER BUREAU, DATED JUNE 1967, AND FROM A SET OF PLANS ENTITLED "RESERVOIR NO. 6 WATER TREATMENT PLANT, STAGE I, WATER BUREAU CONTRACT 793" BY BUCK, SEIFERT AND JUST CONSULTING ENGINEERS, DATED FEBRUARY 1968.

2 ELEVATIONS SHOWN ARE METROPOLITAN DISTRICT DATUM (MCD) WHICH IS 21 FEET BELOW THE MEAN SEA LEVEL DATUM (MSL). A GRAPHIC REPRESENTATION OF THE CONVERSION IS INCLUDED ON THIS PLAN.

3 ² PICTURE NUMBER AND APPROXIMATE DIRECTION

100 MSL = 121 MCD
ELEV 100 MCD = ELEV 121 MSL
DATUM CONVERSION

CAHN ENGINEERS INC WALLINGFORD, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS
--	---

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

HARTFORD RESERVOIR No. 6 DAM

TR-TUMBLE BROOK BLOOMFIELD, WEST HARTFORD CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED
WJH	GRG	YAH	DATE JUNE 1979

PLATE-2

HARTFORD RESERVOIR NO. 6
EXISTING PLANS

"Cross Section of Concrete Wall"
Reservoir No. 6
Hartford Water Works

"Cross Section of Masonry at Overflow"
Reservoir No. 6
W. E. Johnson, Civil Engineer
E. M. Peck, Ass't.

"Map of Reservoir No. 6"
Hartford city Water Works
1895

"Reservoir 6 Improvements"
The Metropolitan District
Hartford County, Conn.
Sept., 1964 (Set of 7)

"Reservoir 6 Filtration Plant Access Road
Grading and Drainage"
The Metropolitan District
Hartford County, Conn.
April, 1965

"Reservoir 6 Water Treatment Plant"
Stage I
Buck, Siefert and Jost
Consulting Engineers
Englewood Cliffs, N.J.
February, 1968

"Reservoir 6 Filtration Plant Access Road -
Paving and Appurtenances"
The Metropolitan District
Hartford County, Conn.
June, 1971 (Set of 2)

"Revisions to Reservoir No. 6
20-inch Blowoff"
The Metropolitan District
Hartford County, Conn.
Sept., 1973

SUMMARY OF DATA AND CORRESPONDENCE

<u>DATE</u>	<u>TO</u>	<u>FROM</u>	<u>SUBJECT</u>	<u>PAGE</u>
No Date	Files	The Water Bureau of The Metropolitan District Office of the Manager	Inventory Data	B-4
Aug. 19, 1955	Files	The Water Bureau of The Metropolitan District Office of the Manager	West Hartford Reservoirs Reservoir Stages during flood Aug. 18-19, 1955	B-6
Oct. 16, 1955	Files	The Water Bureau of The Metropolitan District Office of the Manager	West Hartford Reservoirs Reservoir stages during flood Oct. 16-17, 1955	B-7
July 23, 1956	Files	The Water Bureau of The Metropolitan District Office of the Manager	West Hartford Reservoirs Computed spillway discharge rates	B-8
Aug. 31, 1956	Files	The Water Bureau of The Metropolitan District Office of the Manager	West Hartford Reservoirs capacities	B-9
June 18, 1963	Files	The Water Bureau of The Metropolitan District Office of the Manager	West Hartford Reservoirs improvements in Hydrologic capacity	B-10
Sept., 1963	Files	The Water Bureau of The Metropolitan District Office of the Manager	West Hartford Reservoirs spillway capacities	B-11
Sept., 1963	Files	The Water Bureau of The Metropolitan District Office of the Manager	West Hartford Reservoirs flood capacity studies	B-12

<u>DATE</u>	<u>TO</u>	<u>FROM</u>	<u>SUBJECT</u>	<u>PAGE</u>
Oct., 1963	Files	The Water Bureau of The Metropolitan District Chief Engineer Office	Flood routing of Park River Basin through Reservoir No. 6	B-13
March 5, 6 1964	Files	The Water Bureau of The Metropolitan District Chief Engineer Office	West Hartford Reservoirs Criteria for Hydrologic improvements	B-16
March 16, 1964	Files	The Water Bureau of The Metropolitan District Chief Engineers Office	Statistics for flood routing computations	B-20
March, 1964	Files	The Water Bureau of The Metropolitan District Chief Engineers Office	Flood routing of Emergency storm	B-21
April, 1964	Files	The Water Bureau of The Metropolitan District Chief Engineers Office	Flood routing computations	B-26
May 6, 1964	Metropolitan District Commission	Water Resources Com- mission Supervision of Dams	Inventory Data	B-29
June, 1964	Files	Water Bureau of The Metropolitan District	Hydrological results of Design storms and recom- mendations	B-30
Oct. 20, 1978	Files	Water Bureau of The Metropolitan District	Inspection of dams and spillways	B-33

1. Name of Municipality, Comm.

Reservoir No. 6 in West Hartford and Bloomfield, Conn. on Tumbledown Brook
The Dam or Dams (3 dams)

1. By whom designed? Engineers for the City of Hartford Board of Water Commissioners
2. By whom constructed? Not known
3. Year constructed? 1891-1895

4. Type-

(a) Earth with or without riprap facing

(b) Earth with concrete core wall with or without riprap facing) Yes, with riprap

(c) Concrete

(d) Other

5. Size-

	South dam	Short East	Long East
(a) Length	400 ft.	600 ft.	3,500 ft.
(b) Height	14	10	35
(c) Width at base	80	80	150 ← Estimated
(d) Width at top	15	20	30

6. Anchorage-

(a) How are wings of dam secured? (Built into rock ledge, earth hillside, etc.)

South dam - not known. Other dams - rock ledge

(b) Foundation under dam. (Foundation rock, earth, etc.)

South dam - probably rock. Other dams - rock

7. Water Impounded-

(a) Area 141 acres.

(b) Average depth 17 ft.

(c) Depth at Spillway 1 ft.

(d) Depth at dam S. Dam 10 ft. Short E. dam 6 ft. Long E. dam 31 ft.

(e) Water Supply: 1-River ✓
2-Spring

(f) Length of time to refill - - - - - 9 months

1. Approximate area of water used Kept virtually full

(g) What is the water used for?

Water supply reserve

(Reservoir No. 6)

8. Control -

- (a) Gates: 1 @ 20" connected to pipe line to Reservoir 5.
1. Size
2. Number Blowoff to stream - 1 @ 16"
3. Location with respect to bottom of dam

(b) Diversion tunnels

1. Number —
2. Size —

(c) Spillway

1. Size 50 ft. long
2. Elevation with top of dam Freeboard $4\frac{1}{2}$ ft.

Condition

1. Maintenance Inspection and Operation. Frequent
2. Erosion or deterioration of dam structure None
3. Seepage through dam
(a) Give location and approximate amount Negligible
4. Use made of property bordering lake area Parkland
(a) How affected by lowering of water level? None

Public Exposure at Dam Site

1. Road across dam Gravel service road across all dams
2. Is public allowed access to dam Yes
3. Is supervision maintained full time No

Conditions Down Stream From Dam

1. Slope of land from base of dam down stream
2. Give width of valley or gorge below dam
3. Does spillway discharge into this valley, gorge or river bed
4. Number of bridges that might be affected by flood conditions should dam rupture
(a) Give size and stability of structure
5. Buildings and structures that would be affected by dam failure (power plants, piers, etc.)
6. Dams, weirs and flood gates in stream bed which might be affected by dam failure
(a) Size
(b) Distance from dam in question

West Hartford Reservoirs - Reservoir stages as recorded
by A.J.M. during flood of Aug. 18-19, 1955

Aug. 19, 1955

Res. No. 1 - No flashboard

1:10 P.M. - 2'-8" over spillway

2:05 P.M. - 3'-0" " "

4:05 P.M. - 2'-9" " "

6:30 P.M. - 2'-0" " "

Res. No. 2

12 NOON - 1'-8" over spillway

1:40 P.M. - 1'-6" " "

7:00 P.M. - 0'-10" " "

Res. No. 5 11:00 A.M. - 2'-0"

1:00 P.M. - 1'-6" over spillway

1:20 P.M. - 1'-7" " "

2:00 P.M. - 1'-5" " "

{ 16" B.O. valve at foot of No. 5 Dam
opened 10 turns at 1:40 P.M.

3:00 P.M. - 1'-2 $\frac{1}{2}$ " " "

4:00 P.M. - 0'-11" " "

6:45 P.M. - 0'-9" " "

Res. No. 6

1:30 P.M. - 2.5' over weir

Reference taken from H-2691.23

West Hartford Reservoirs - Reservoir stages as recorded
by A.J.M. during flood of Oct. 16, 17, 1955

October 16, 1955

<u>Res. No. 1</u>		<u>Res. No. 2</u>		<u>Res. No. 3</u>		<u>Res. No. 5</u>		<u>Res. No. 6</u>	
<u>Time</u>	<u>Depth</u>	<u>Time</u>	<u>Depth</u>	<u>Time</u>	<u>Depth</u>	<u>Time</u>	<u>Depth</u>	<u>Time</u>	<u>Depth</u>
7:0 AM	Closed B.O.								
3:30 AM	24.0'	8:30 AM	14" Over	—	—	8:30 AM	10" Over	8:30 AM	29.10'
1:3 AM	26.1'	9:30 AM	14" Over	9:30 AM	15" Over	9:30 AM	10½" Over	12:45 PM	29.10'
1:2 AM	29.9'	11:38 AM	11½" Over	11:31 AM	16¾" Over	12:00 Noon	11½" Over	2:00 PM	29.08'
1:30	opened B.O.								
2:50 PM	31.8'	1:05 PM	11½" Over	2:21 PM	17½" Over	1:05 PM	10½" Over	3:15 PM	29.05'
2:55 PM	33.0'	2:16 PM	10½" Over	3:40 PM	17½" Over	2:30 PM	10" Over	<u>Oct. 17, 1955</u>	
2:7 PM	33.4'	3:35 PM	10" Over	4:20 PM	17½" Over	3:46 PM	9½" Over	8:00 AM	28.55'
3:17 PM	34.15'	4:13 PM	9¾" Over	5:25 PM	16¾" Over	4:25 PM	9½" Over		
4:10 PM	34.60'	5:13 PM	9½" Over	6:00 PM	16½" Over	5:25 PM	8½" Over		
5:5 PM	34.75'	5:53 PM	9¾" Over	<u>Oct. 17, 1955</u>		6:04 PM	8¾" Over		
5:10 PM	34.81'	<u>Oct. 17, 1955</u>		9:00 AM	9½" Over	<u>Oct. 17, 1955</u>			
7:15 PM	34.75'	8:45 AM	3½" Over			9:00 AM	3½" Over		
8:5 PM	34.70'								
9:5 PM	34.60'								
10:15 PM	34.55'								
11:15 PM	34.52'								
<u>Oct. 17, 1955</u>									
12:15 AM	34.45'								
1:15 AM	34.40'								
4:5 AM	34.20'								
6:15 AM	34.10'								
8:10 AM	33.80'								

Reference taken from H-2691.26

Res. No	Nominal Elev. Top of Dam	Flow Line Elev	STATUS	(a) Total Spillway Discharge Capacity CFS	Total Watershed Sq. Mils.	(b) Unit Spillway Discharge Capacity (reflecting pondage) $\frac{CFS}{Sq. Mils.}$ Inches/Hr.
1	268.	259.0	Present capacity governed by 5.0' height of weir abutments. If weir abutments and fill behind them are raised to Elev. 267.6 (present low dam),	1,330.	15.13 consisting of: #1-245 #3-0.47 #2-500-1.12	(a) 0.4
2	332	327	Present capacity governed by 1.7' freeboard on east side of Dyke Pond. If road on east side of Dyke Pond is raised to Elev. 332 (26' max.) and weir abutments and fill behind are raised to Elev. 332 (18' max.)	280.		0.3
3	399. +	393.7	Present capacity governed by 2.2' freeboard on road at N.E. end of reservoir. If road at N.E. end is raised to Elev. 396.7 (28' max.) to bring it up to grade of other extensive low areas around east side	100.	0.47	0.3
5	326 ±		Present capacity governed by 3.1' freeboard at low points on dam. If dam and road on east side of reservoir are raised to Elev. 326.0 (0' max.)	160.		0.5
6	406.	(c) 401.0	Present capacity governed by 4.4' freeboard on road at S.E. end of reservoir. If low point in road at S.E. end is raised to Elev. 406.0 (0.4' max.)	1,500.	2.71 consisting of: #1-140 #1.5 #2-500-0.8	(d) 0.5
				1,800.		0.6
				1,500.		0.8
				1,800.		1.0

(a) Computed on assumptions of coefficients, etc.

(b) Based on total watershed (or sheds) tributary.

(c) With permanent 12-inch flashboards in place.

(d) Reducing discharge capacities by inflow from:

upstream reservoirs, the unit discharges are:
 Res. #1 - $[1330 \text{ cfs} - 100 \text{ (cfs)}] \div 245 \text{ sq. mi.} = 4.0 \text{ cfs/sq. mi. or } 0.4 \text{ in.}$
 " #1 - $[3050 \text{ " } - 160 \text{ " } - 880 \text{ "}] \div 245 \text{ " } = 820 \text{ " or } 1.3 \text{ "}$
 Res. #5 - $[650 \text{ " } - 280 \text{ (cfs)}] \div 0.81 \text{ " } = 455 \text{ " or } 0.7 \text{ "}$
 " #5 - $[880 \text{ " } - 1130 \text{ "}]$ Cannot even pass inflow from Res. #2

NOTE:

The peak unit discharges on August 19, 1955 varied from a low of 0.1 inches per hour from the Res. #5 watershed (plus passing the Res. #2 discharge at that time) to a high of 0.4 inches per hour from the Res. #6 watershed.

For comparison, it should be noted that the Bartonsville Reservoir with a watershed area of 5 1/2 square miles (20 to 100 times as large) had peak inflow rates of 12 inches per hour plus, on August 19, 1955. Had the same rainfall pattern prevailed on the West Hartford Reservoir area, there is little doubt that runoff rates would have equaled or exceeded 2 inches per hour.

It is probably feasible to increase the discharge capacities of the West Hartford Reservoirs to 2 inches per hour by raising the present freeboard, increasing weir lengths or elevations, or some combination of these.

FEDERAL BUREAU OF HYDROLOGIC INVESTIGATION WASHINGTON, D. C.	SUBJECT WEST HARTFORD RESERVOIRS - Study of		
	Improvements in Hydrologic Capacity		FILE No.
			Acc. No. H-3546.1
	COMPUTER <i>EPG</i>	CHECKED BY	DATE 6/18/63

PRESENT CAPACITIES

Refer to Acc. H-2771.8 and related computations made in 1956, following the 1955 storms.

Present spillway capacities range from 200 to 530 cubic feet per second per square mile of watershed which is equivalent to 0.2 to 0.8 inches per hour.

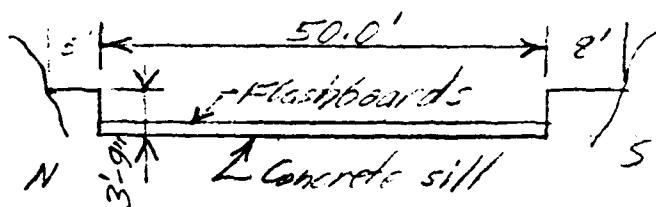
Present freeboard is:

5'-0" ± on Res. No. 1, of which 3'-0" was utilized in August 1955.	
	(was empty)
1'-8" ± on Res. No. 2, <u>ALL</u> of which "	" " " "
	(was down 6')
2'-2" ± on Res. No. 3, <u>ALL</u> of which "	" " " "
	(was down 5')
3'-1" ± on Res. No. 5, of which 2'-0" ± "	" " " "
	(was down 4')
4'-5" ± on Res. No. 6, of which 2'-6" ± "	" " " "
	(was down 1½')

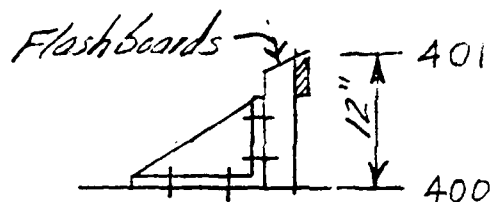
FORM 3-6 NEW YORK STATE BUREAU OF METROPOLITAN DISTRICT CIVIL ENGINEER'S OFFICE	SUBJECT <u>WEST HARTFORD RESERVOIR</u> <u>Spilling Capacity</u>	FILE No.
COMPUTER <u>G. E. 211</u>	CHECKED BY	Acc. No. <u>H-3546.27</u> DATE <u>Sept 1963</u>

RESERVOIR DATA

Reservoir No. 6



ELEVATION



SECTION

Watershed = 2.0 Square Miles

$$Q_d = C L H^{3/2}$$

Use $C = 3.10$ and compute
all discharge from top of weir
or Elev. 401 (discharge with LRT and PTR)

<u>PONDAGE</u>	Elev	M.G	Δ
	392	676.1	
	399	721.6	
	400	765.1	
	401	809.1	44.0 ✓

USE 44.0 M.G./ft for pondage effect

$$\frac{44.0}{7.48} = \underline{\underline{5.88 \text{ Mil. Cu. Ft./Ft.}}}$$

D.M.S.
WATER BUREAU OF
PROP. ITAN DISTRICT
ENG. OFFICE

SUBJECT WEST HARTFORD RESERVOIR
Flood Capacity Studies
COMPUTER J.E.M. CHECKED BY

FILE No.
Acc. No. H-3546.28
DATE Sept 1963

RESERVOIR No. 6

Wet discharge $Q = CLH^{3/2}$ $L = 50.0'$ per H-2771.5
 $C = 3.1$ per LRT & T2-7

$$Q = CLH^{3/2} = 3.1(50)H^{3/2} = 155H^{3/2}$$

HEAD (feet)	Discharge Qd in CFS	HEAD (feet)	Discharge Qd in CFS
0	-	3.0	805.38
.1	4.90	3.5	1,014.94
.2	13.86	4.0	1,240.00
.3	25.47	4.5	1,479.63
.4	39.22	5.0	1,732.90
.5	54.81	5.5	1,999.50
.6	72.04	6.0	2,278.50
.7	90.78	6.5	2,568.35
.8	110.90	7.0	2,870.60
.9	132.34	7.5	3,183.70
1.0	155.00	8.0	3,507.65
1.1	178.82		
1.2	203.75	2.80	726.18
1.3	229.74	2.90	765.39
1.4	256.76	3.35	950.46
1.5	284.74	3.15	866.61
1.6	313.72		
1.7	343.48		
1.8	374.33		
1.9	405.95		
2.0	438.34		
2.1	471.67		
2.2	505.77		
2.3	540.64		
2.4	576.30		
2.5	612.72		
2.6	650.23		

FINAL

REGIONAL OFFICE	SUBJECT <u>FLOOD ROUTING OF PARK RIVER BASIN</u>	(File here as final also)
LOCAL DISTRICT	<u>Project Storm "B" - 18.21" in 34 hours</u>	FILE NO.
NEED OFFICE	<u>Through Reservoir No. 6</u>	Acc. No. <u>H-3546, III</u>
COMPUTER <u>J.E.M.</u>	CHECKED <u>E</u>	DATE <u>Oct. 1963</u>

PROJECT STORM (with 100% Presumed Spillway Capacity)
without bridge

R6

TIME	ΔT (SEC.)	Q RATE (CFS)	ΔQ _i (1,000 FT ³)	Sur Charge (FT)	Qd Rate (CFS)	ΔQ _d (1,000 FT ³)	Δ Storage (1,000 FT ³)	ΔQ _d + ΔS (1,000 FT ³)	Error (1,000 FT ³)
3:00	-	-	-	-	-	-	-	-	-
5:00	5,400	540	1,458	0.24	19	51	1,411	1,462	+4
6:00	3,600	260	1,440	0.46	49	122	1,294	1,416	-24
7:00	3,600	420	1,224	0.63	78	229	1,000	1,229	+5
8:00	3,600	200	1,116	0.76	103	326	764	1,090	-26
9:00	3,600	840	1,872	1.00	155	464	1,411	1,875	+3
10:00	3,600	80	1,656	1.17	196	632	1,000	1,632	-24
11:00	3,600	100	324	1.11	182	680	-353	327	+3
12:00	3,600	240	612	1.10	179	650	-59	591	-21
13:00	3,600	60	540	1.08	174	635	-118	517	-23
16:00	10,800	60	648	0.91	134	1,663	-1,000	663	+15
18:00	7,200	900	3,456	1.28	225	1,292	2,176	3,468	+12
19:00	3,600	640	2,772	1.59	311	965	1,823	2,788	+6
22:00	10,800	1,880	13,608	2.91	766	5,816	7,762	13,578	-30
23:00	3,600	1,280	5,688	3.35	950	3,089	2,587	5,676	-12
24:00	3,600	1,280	4,608	3.53	1,029	3,562	1,058	4,620	+12
24:36	2,160	960	2,419	3.56	1,041	2,236	176	2,412	-7
25:36	3,600	1,360	4,276	3.64	1,076	3,811	470	4,281	+5
26:36	3,600	800	3,888	3.64	1,076	3,874	0	3,874	-14
28:00	5,040	600	3,528	3.37	959	5,128	-1,588	3,540	+12
31:00	10,800	200	4,320	2.62	657	8,726	-4,410	4,316	-4

FOR THE
METROPOLITAN DISTRICT
ENGINEER'S OFFICE

SUBJECT FLOOD RETAINING OF PINE RIVER
Basin Design Storm - 18.22" in 24 hrs
Through Reservoir No. 6
COMPUTER W.E.M. CHECKED BY

FINAL
(File how as final also)
FILE No. 83
ACC. No. H-3546-112
DATE Oct. 1963

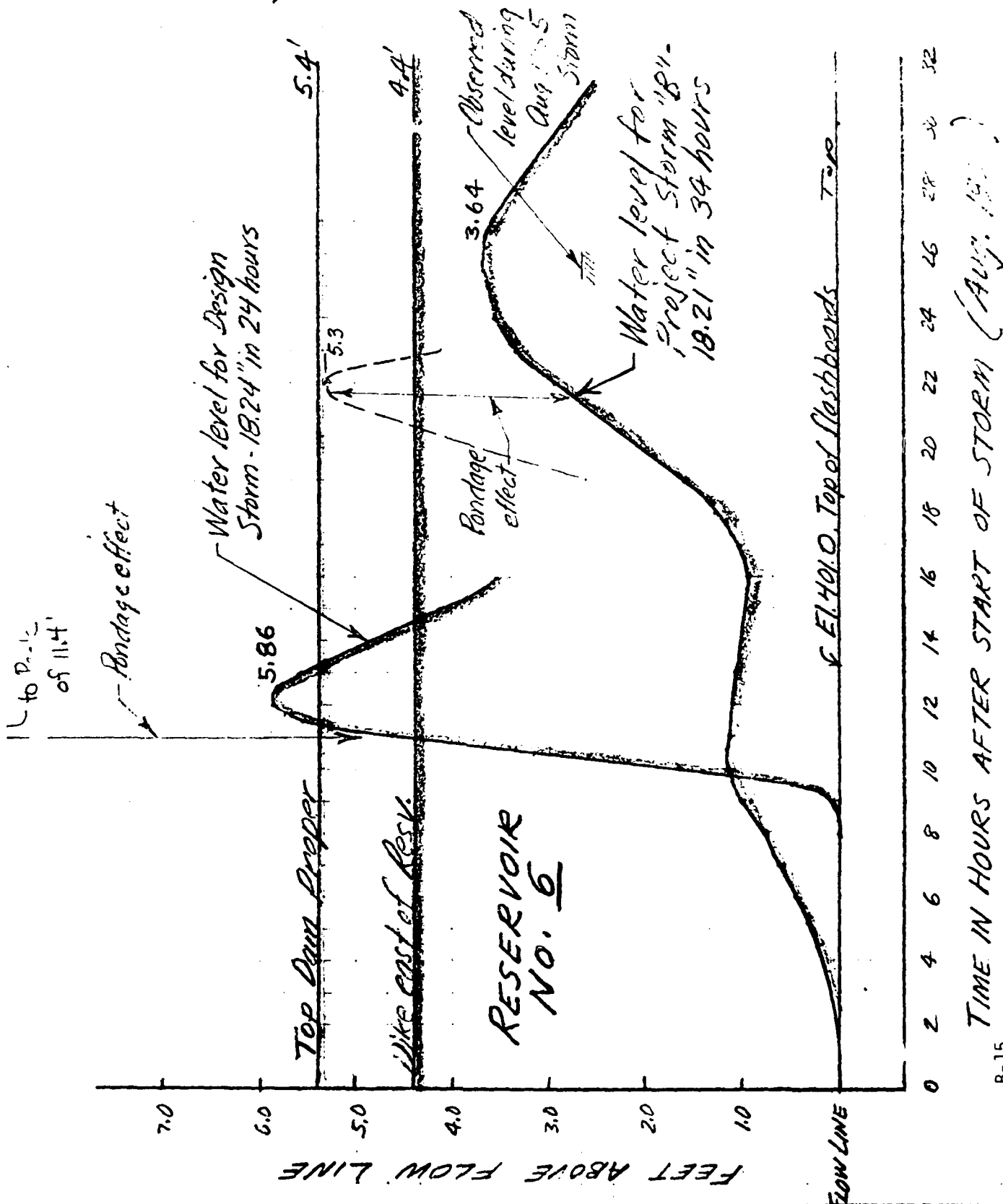
EMERGENCY STORM (100% Present Spillway Capacity)
without bridge

R.C.

TIME	ΔT (Sec.)	Q_i Rate (cfs)	ΔQ_i (1,000 ft ³)	Sur charge (ft)	Q_d Rate (cfs)	$L Q_d$ (1,000 ft ³)	D Storage (1,000 ft ³)	$\Delta Q_d + D$ (1,000 ft ³)	
8:00	-	25,200	-	Assume 0.014 ft	-	355.20	5.88 x 41	-	-
8:30	1,800	4072	72	0.01	.5	1	59	60	-12
9:00	1,800	280	324	0.07	3	3	343	346	+22
9:30	1,800	2,600	2,592	0.50	55	52	2,528	2,580	-12
10:00	1,800	5,280	7,092	1.65	329	346	6,762	7,108	+16
10:30	1,800	5,840	10,008	3.17	875	1,084	8,938	10,012	+4
11:00	1,800	5,960	10,620	4.61	1,534	2,168	8,467	10,635	+15
11:30	1,800	3,700	8,694	5.54	2,021	3,200	5,468	8,668	-26
12:00	1,800	2,600	5,670	5.86	2,199	3,798	1,882	5,680	+10
12:30	1,800	1,520	3,708	5.82	2,176	3,938	-235	3,703	-5
13:00	1,800	900	2,178	5.55	2,026	3,782	-1,588	2,194	+16
14:00	3,600	400	2,340	4.83	1,645	6,608	-4,237	2,371	+31
15:00	3,600	240	1,152	4.12	1,296	5,294	-4,175	1,119	-33
16:00	3,600	160	720	3.53	1,028	4,183	-3,469	714	-6

WATER BUREAU OF
 ALTA DISTRICT
 ENGINEER'S OFFICE

THROUGH RESERVOIR No. 6		FILE No.
COMPUTER J. E. M.		Acc. No. H-3546.31
CHECKED BY		DATE Oct. 1963



HYDRO BUREAU OF	SUBJECT WEST LAKES AND RESERVOIRS -		FILE NO.
OPDIVISION AND DISTRICT	Study of Hydrologic Improvements		Acc. No. H-3546.32
ENGINEER'S OFFICE	Discussion of Possible Criteria		DATE Yr. 5, 1964
COMPUTER	FPJ	CHECKED BY	

In order of decreasing magnitude, the following hydrologic criteria are worthy of mention and discussion:

Maximum Conceivable Flood

This term covers a "family of floods". It is used to define a peak flow rate as derived by the Kinnison-Colby formulae. It is more realistically used as the run-off hydrograph resulting from any one of the "probable maximum precipitation" charts of the U.S. Weather Bureau.

As a range of magnitude, the U.S. Weather Bureau's Technical Paper No. 40 gives 24" in 6 hours as the Probable Maximum Precipitation for a 10-Square mile Area.

Further, Kinnison-Colby's formula (for a one-square mile watershed with 500 foot average fall and one mile average travel) would yield:

$$Q = (0.128 \times 200 + 1,800) \frac{(1.0)^{0.9}}{(1.0)^{0.7}} = 6,800 \text{ cfs} \approx \underline{6.8 \text{ inches/hour}}$$

There is no hydraulic structure, within the knowledge of this writer, that is designed for this magnitude of storm or flood. In such an occurrence, the failure of our dams would add but little to the disaster and would logically be classed as an act of God.

Spillway Design Storm

As created and defined in Metcalf & Eddy's 1958 Report "Part I - Park River Hydrology - Control of Floods in Park River", this storm is arbitrary and synthetic and is recommended for the Design of Reservoir Spillways within the Park River Basin.

This rainfall pattern is shown on Acc. H-3546.10 and totals 18.74" in 24 hours, consisting of 13.55" in 3 hours, preceded and followed by light rain. This 13.55" in 3 hours is two-thirds of the estimated maximum possible 6-hour rainfall over 50 sq. mi., which is general practice of the Corps of Engineers for areas less than 50 sq. mi.

WATER BUREAU OF	SUBJECT		FILE No.
LYNN PLATAN DISTRICT			Acc. No. H-3546.33
FIELD ENGINEER'S OFFICE			DATE Mar. 5, 1964
COMPUTER	EPG	CHECKED BY	

The Unit Hydrograph from an Idealized Watershed resulting from this storm is shown on Acc. H-3546.18.

It is felt, as stated in the report, that there will be a considerable factor of safety afforded by spillways capable of handling the reservoir discharges resulting from this storm. This then should be the ceiling flood which our reservoirs should be asked to pass with/or without some monetary damage.

Park River Project Storm "B"

As created and defined in Mearns & Eddy's 1958 Report "Part I - Park River Hydrology - Control of Floods in Park River"; this is a rainstorm of similar magnitude and distribution to the greatest storm on record and is recommended for evaluation of degree of control to be afforded by possible flood control reservoirs in the Park River Basin.

This rainfall pattern is shown on Acc. H-3546.10 and totals 18.24" in 34 hours falling in two major durations as in the 1955 storm. The rainfall total and distribution pattern is the weighted average of the August 1955 storm in the 20 sq. mi. Westfield, Mass. area, which was the center of the storm.

The Unit Hydrograph from an Idealized Watershed resulting from this storm is shown on Acc. H-3546.18.

It is felt that our reservoirs should be capable of passing this storm with normal freeboard and factors of safety. Minor monetary damage such as localized wash, etc. can probably be tolerated, however.

Park River Conduit Design Storm

In designing the Park River Conduit, the Corps of Engineers used a total rainfall of 16.1" which was the total during the worst storm on record at that time (1938). The storm duration was arbitrarily reduced to 48 hours from the 96 hours actually experienced during the 1938 storm.

Flood effects from this storm would be somewhat less than the Park River Project Storm "B" above and will not be used.

FORM 2-8
THE WATER BUREAU OF
METROPOLITAN DISTRICT
ENGINEER'S OFFICE

SUBJECT

FILE NO.

ACC. NO. H-3546.34

COMPUTER

SPF

CHECKED BY

DATE Mar. 6, 1964

Pack River Project Storm

As defined in the M&E Report, this is the average of the actual rainfall experience in the Hartford-West Hartford area during the August 1955 storm.

This rainfall pattern is shown on Acc. H-3546.10 and totals 11.71" in 32 hours, falling in two major durations.

The Unit Hydrograph for this storm is shown on Acc. H-3546.18.

There is no question but that our reservoirs should be capable of passing a repeat of this storm with conservative safety factors.

WEST HARTFORD RESERVOIR
Study of Hydrologic Engineering

L.H.
Doc. H-3546.2
March 6, 1961

DESIGN SECTION

NOTE -

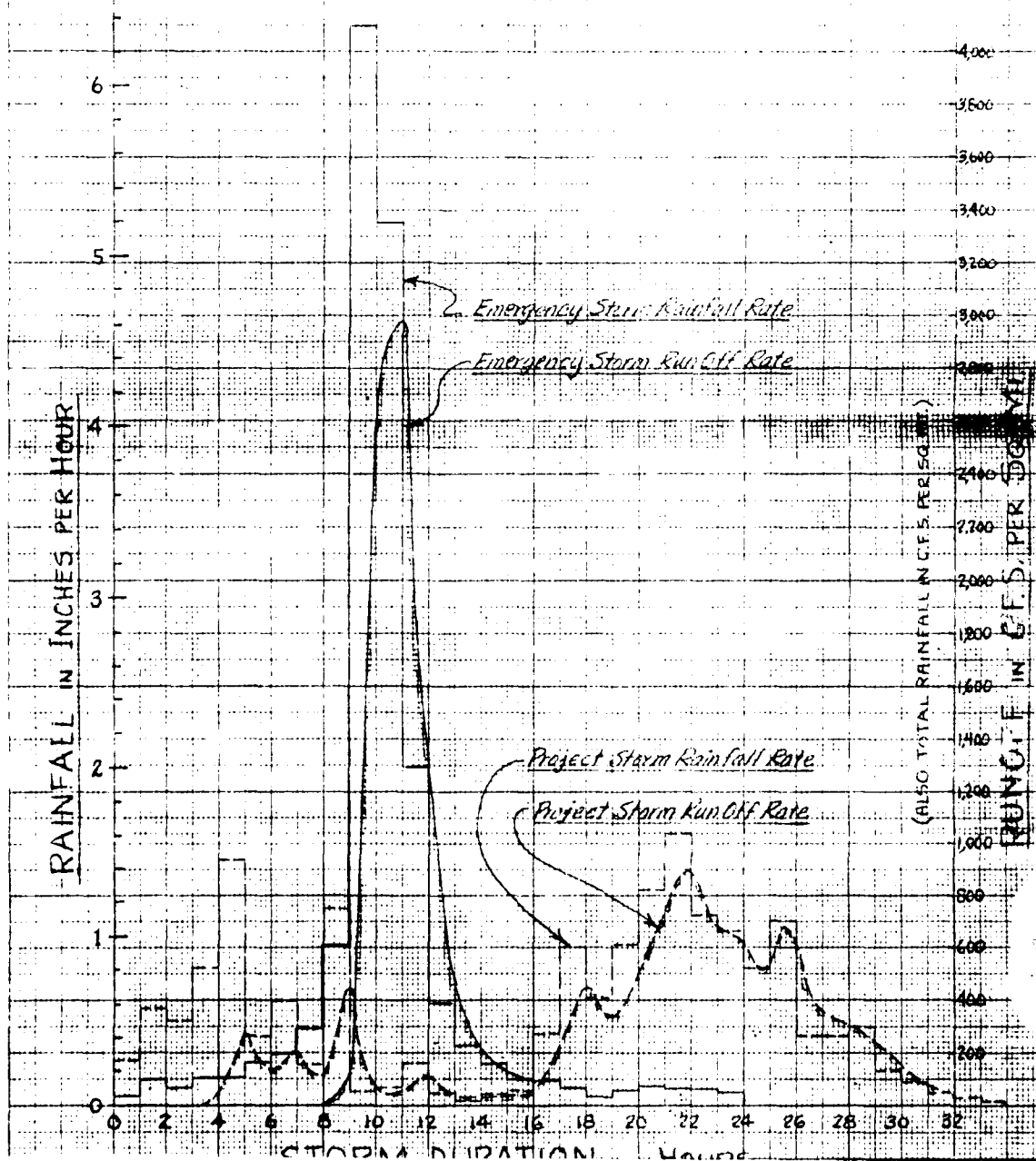
The Run Off Hydrographs shown are based on an Idealized Watershed of 1.0 Sq. Mi. area, 30-Minute concentration period, Class B soil, group and wet wood land in good condition as per Engineering Handbook, Section 4-Hydrology, Supplement A, Soil Conservation Service, U.S. Dept. of Agriculture.

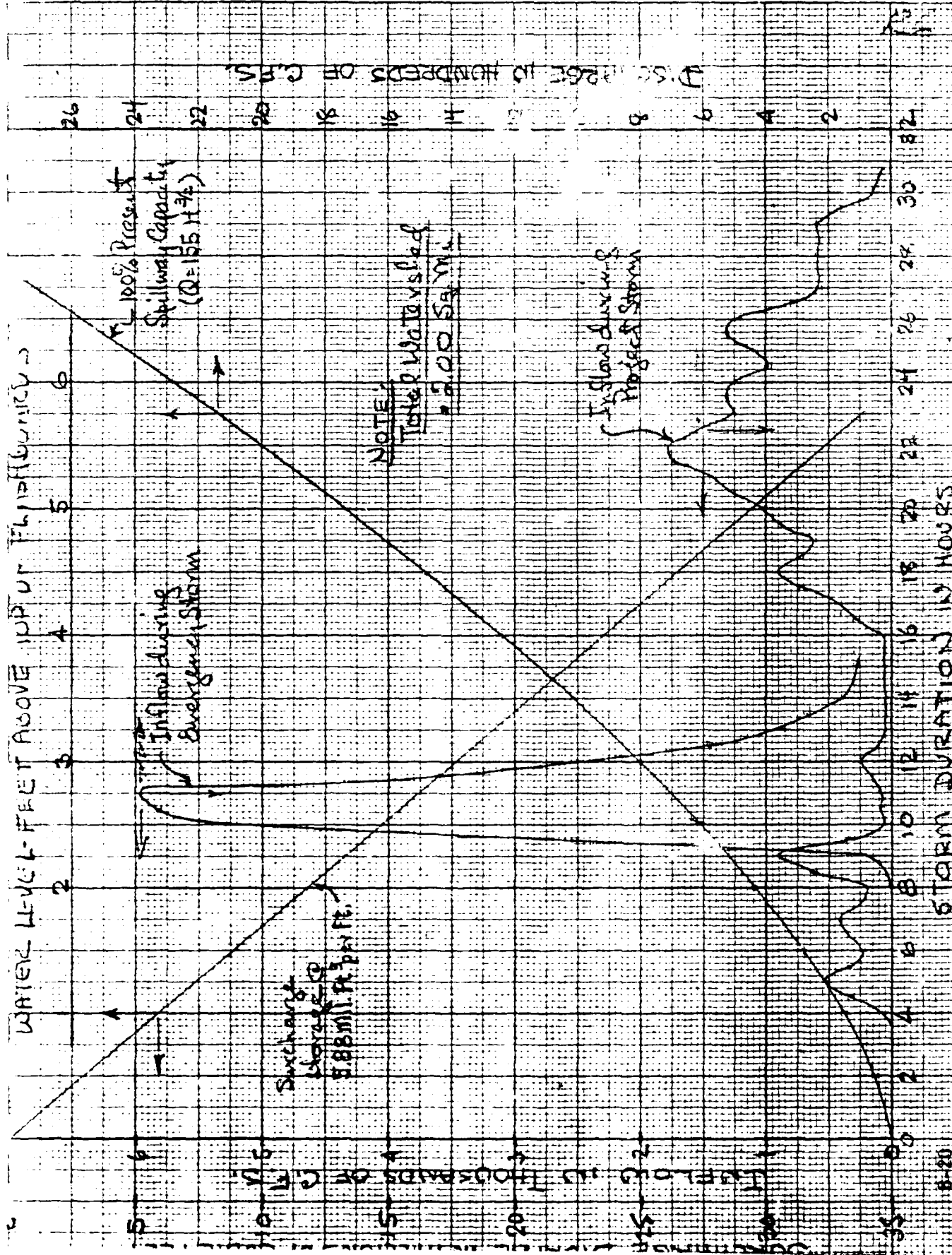
Design Storm - 18.24 in 24 hours

This is Park River Projects Storm B, which is weighted average of actual August 1955 rainfall in the Westfield, Mass. area.

Design Storm - 18.24 in 24 hours

This is Park River Projects Synthetic Design Storm which is the general practice of the U.S. Army Corps of Engineers.





Water Bureau of

Metropolitan District

Office of the Manager

Hartford, Conn.

FLOOD ROUTING OF

Subject EMERGENCY STORMTHROUGH RESERVOIR No. 6Computer G. E. M.

Checked by

150% PrecipCapacity

File No.

Acc. No. 3546.114Date Mar 1964

TIME	ΔT (SEC)	Q_i RATE (CFS)	ΔQ_i (1,000 FT. ³)	SUR- CHARGE (FT)	Q_d RATE (CFS)	ΔQ_d (1,000 FT. ³)	Δ STORAGE (1,000 FT. ³)	$Q_d + \Delta S$ (1,000 FT. ³)	ERROR (1,000 FT. ³)
1:00									
6:30	1,800	80	72	0.01	0.75	1	59	60	-12
7:00	1,800	280	324	0.10	7.4	7	549	556	+232 (+2)
7:30	1,800	2,600	2,592	0.50	82	81	2,352	2,433	-159 (+61)
7:00	1,800	5,280	7,092	1.60	471	497	6,468	6,965	-127 (-63)
8:30	1,800	5,840	10,008	3.00	1205	1,690	8,232	9,912	-96 (-162)
11:00	1,800	5,960	10,620	4.50	2,220	1,998	8,820	10,818	+198 (+2)
11:30	1,800	3,700	8,694	5.25	2,797	4,500	4,410	8,910	+216 (+156)
12:00	1,800	2,600	5,670	5.4	2,918	5,150	882	6,032	+362 (+614)
2:30	1,800	1,520	3,708	5.2	2,757	5,100	1,176	3,924	+216 (+506)
				5.15	2,717	5,070	-1,470	3,600	-108
3:00	1,800	900	2,178	4.00	1,860	8,250	6,760	1,490	-280
				4.70	2,369	4,575	-2,646	1,929	-249 (+257)
4:00	3,600	400	2,340	3.80	1,722	7,350	-5,290	2,060	-280 (-23)
5:00	3,600	240	1,152	3.10	1,268	5,390	-4,116	1,274	+122 (+95)
16:00	3,600	160	720	2.5	919	3,950	-3,528	422	-298 (-195)

FLOOD ROUTING OF

Subject **PROJECT STORM**

THROUGH RESERVOIR No. 6

Computer **A.E.M.**

Check by

50% Reservoir

Spillway

Capacity

File No.

Acc. No. **43546.113**

Date **Mar. 1964**

TIME	ΔT (SEC.)	Q _{IRATE} (CFS)	ΔQ _i (1,000 FT. ³)	SUR- CHARGE (FT.)	Q _d RATE (CFS)	ΔQ _d (1,000 FT. ³)	ΔSTORAGE (1,000 FT. ³)	ΔQ _d +ΔS (1,000 FT. ³)	RE ERROR (1,000 FT. ³)
5:00		540	1,458	0.2	21	57	1,375	1,432	-26
5:10	3,600	260	1,440	0.4	59	144	1,176	1,320	-120
7:10	3,600	420	1,224	0.6	102	300	1,176	1,476	+252
8:10	3,600	200	1,116	0.7	136	438	588	1,026	-90
9:10	3,600	840	1,872	0.9	198	601	1,176	1,777	-95
10:10	3,600	80	1,656	1.0	233	775	588	1,363	-293
11:10	3,600	100	324	0.9	198	775	-588	187	-137
12:10	3,600	240	612	1.0	233	775	588	1,363	+297
12:10	3,600	60	540	1.0	233	540	0	840	+320
16:10	10,800	60	648	0.8	167	1,800	-1,176	624	+24
17:10	720	900	3,456	1.1	269	1,570	-1,764	3,334	+122
18:00	3,600	640	2,772	1.3	345	1,100	1,176	2,276	-446
2:00	10,800	1,880	13,608	2.5	909	6,750	7,056	13,806	+198
2:10	3,600	1,280	5,682	2.8	1029	3,595	1,764	5,359	-329
2:20	3,600	1,280	4,608	2.9	1148	4,025	588	4,613	+5
2:36	2,160	960	2,419	2.9	1148	2,480	0	2,480	+61
2:536	3,600	1,360	4,276	2.9	1148	4,133	0	4,133	-143
3:36	3,600	800	3,888	2.9	1148	4,133	0	4,133	+245
28:100	5,040	600	3,528	2.6	975	4,910	-1,764	3,146	-382
3:00	10,800	200	4,320	1.9	609	8,554	-4,116	4,438	+118

FLOOD ROUTING OF

Subject EMERGENCY STORM

THROUGH RESERVOIR

Computer

Check of

Present

File No.

Acc. No. 354

Date Mar. 1964

TIME	ΔT (SEC)	Q RATE (CFS)	ΔQ_i (1000 FT. ³)	SUR- CHARGE (FO)	Q RATE (CFS)	ΔQ (1000 FT. ³)	Δ STORAGE (1000 FT. ³)	Q_{d+AS} (1000 FT. ³)	ERROR (1000 FT. ³)
8:00									
8:30	300	80	72	0.01	1		59	60	-12
9:00	300	280	324	0.10	10	10	529	539	-21
9:30	300	2,600	2,592	0.50	110	102	2,352	2,460	-132
10:00	300	5,280	7,092	1.60	126	665	6,968	7,133	-41
10:30	300	5,840	10,008	2.90	1531	1,250	7,644	9,474	-572
11:00	300	5,960	10,620	4.10	2574	3,410	7,056	10,746	-126
11:30	300	3,700	8,694	4.70	3159	5,150	3,528	8,678	-16
12:00	300	2,600	5,670	4.70	3159	5,686	0	5,686	+16
12:30	300	1,520	3,708	4.40	3010	5,412	1,764	3,654	-54
13:00	300	900	2,178	4.00	2480	4,940	-2,352	2,688	+510
14:00	300	400	2,340	3.10	1692	7,350	-5,292	2,158	-182
15:00	300	290	1,152	2.40	1153	5,120	-4,116	1,004	-148
16:00	300	160	720	1.92	825	3,560	-2,822	738	+18

Metropolitan District

Office of the Manager

Hartford, Conn.

FLOOD ROUTING OF

Subject

PROJECT STORM

THROUGH RESERVOIR NO. 6

Computer

Check

Recent

File No.

Acc. No. H-354615

Date Mar. 1964

TIME	ΔT (SEC)	Q RATE (CFS)	ΔQ (1,000 FT. ³)	SUR- CHARGE (FT)	Qd RATE (CFS)	ΔQ (1,000 FT. ³)	STORAGE (1,000 FT. ³)	Qd + AS (1,000 FT. ³)	ERROR (1,000 FT. ³)	
1:30										
2:00	5,400	540	1,458	0.2	22	1,176	1,252	-206	(+206)	
3:00	3,600	260	1,440	0.4	78	1,176	1,367	-72	(+72)	
4:00	3,600	420	1,224	0.6	144	1,176	1,576	+352	(+352)	
5:00	3,600	200	1,116	0.7	182	586	1,174	+57	(+57)	
6:00	3,600	840	1,872	0.9	265	225	1,176	1,981	+109	(+109)
7:00	3,600	80	1,656	1.0	310	1,012	588	1,606	-50	(+187)
8:00	3,600	100	324	0.9	265	1,015	-588	427	+103	(+243)
9:00	3,600	240	612	0.9	265	955	0	955	+343	(+63)
10:00	3,600	60	540	0.8	222	878	-588	290	-250	(+33)
11:00	10,800	60	648	0.6	144	1,976	1,176	800	+152	(+152)
12:00	720	900	3,456	0.9	265	1,470	1,764	3,234	-222	(+313)
13:00	3,600	640	2,772	1.1	358	1,120	1,176	2,296	-476	(-163)
14:00	10,800	1,880	13,608	2.2	1,012	7,400	6,468	13,868	+260	(+57)
15:00	3,600	1,280	5,688	2.5	1,225	4,030	1,764	5,794	+106	(+203)
16:00	3,600	1,280	4,608	2.5	1,225	4,400	0	4,400	-208	(-5)
17:00	4:36	2,160	2,419	2.5	1,225	2,646	0	2,646	+227	(+222)
18:00	25:36	3,600	4,276	2.5	1,225	4,410	0	4,410	+134	(+358)
19:00	5:36	3,600	3,888	2.4	1,153	4,150	-588	3,562	-326	(+30)
20:00	5:00	600	3,528	2.1	943	5,282	-1,764	3,518	-10	(+20)
21:00	10:00	200	4,326	1.5	570	8,170	-2,028	4,642	+322	(+322)

B-24

W. r Bureau of

FLOOD ROUTING OF

Western District. Subject RESERVOIR No. 6 - Flood Damage - Hartford File No. 16 A
 is of the Manager THROUGH RESERVOIR Acc. No. 3546.122A
 Hartford, Conn.

Computer.

Checked: _____

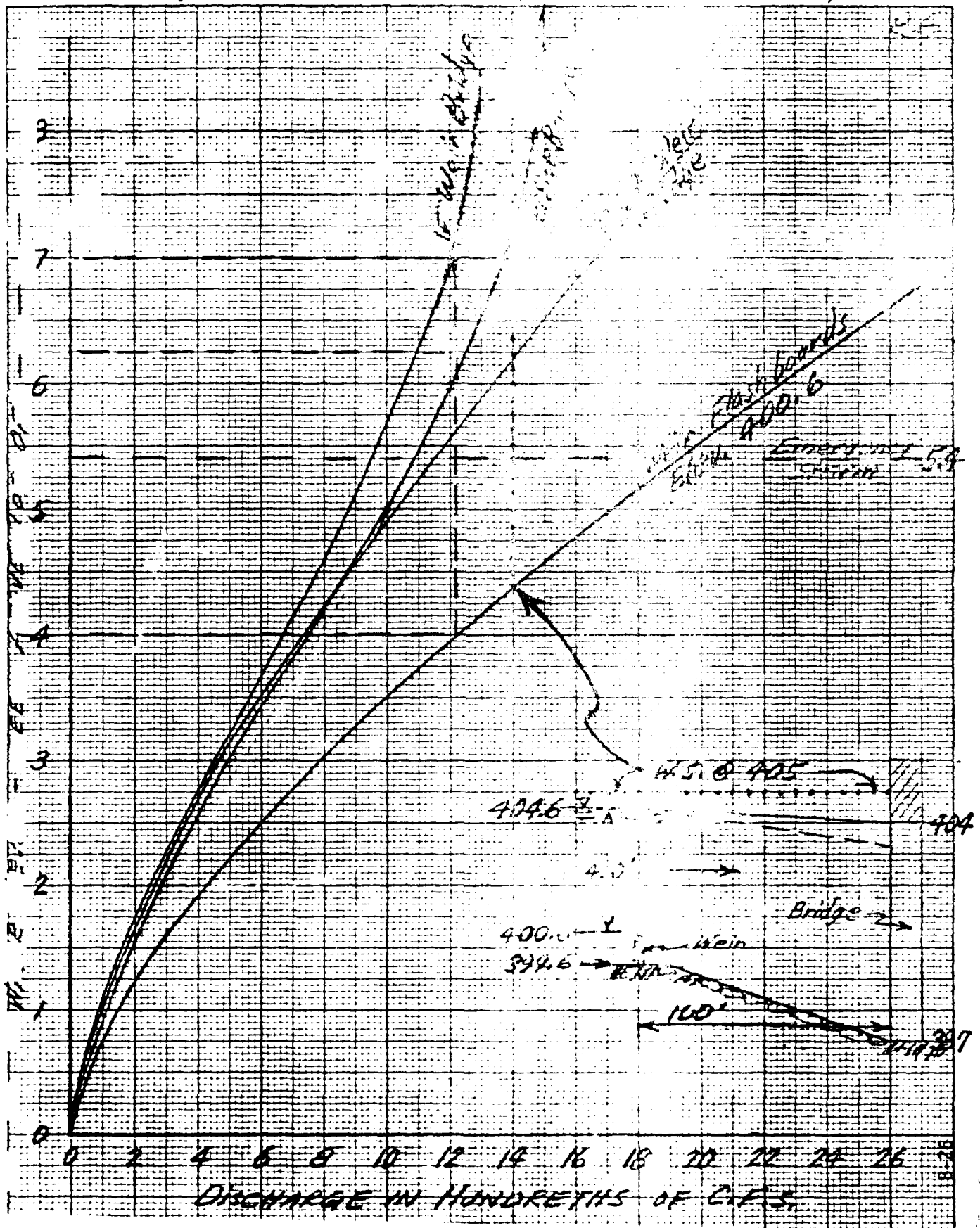
Date _____ 19____

TIME	ΔT (SEC)	Q_i RATE (CFS)	ΔQ_i (1,000 FT. ³)	SUR- CHARGE (FT.)	Q_d RATE (CFS)	Q_d (1,000 FT. ³)	STORAGE (1,000 FT. ³)	$\Delta Q_d + \Delta S$ (1,000 FT. ³)	ERROR (1,000 FT. ³)
9:00	—	—	—	—	—	—	—	—	—
9:10	1:00	180	72	0.01	105	—	—	60	+12
9:20	1:00	280	324	0.07	3	—	—	346	+22
9:30	1:00	2600	2592	0.5	55	5	—	2580	+2
10:00	1:00	5280	7092	1.65	329	329	—	7108	+16
10:30	1:00	5840	10006	3.17	775	775	—	10022	+14
11:00	1:00	5960	10620	4.64	1521	1520	—	10624	+4
11:30	1:00	5700	8694	5.72	1415	1415	—	8695	+1
12:00	1:00	2600	6670	6.25	1455	1453	—	6699	+29
12:30	1:00	1520	3708	6.44	1465	2622	—	3746	+38
1:00	1:00	900	2178	6.36	1455	2628	—	2158	-20
14:00	3:600	400	2340	5.87	1430	5193	—	2312	-28
1:00	3:600	240	1152	5.21	1370	5040	—	1160	+8
16:00	3:600	120	720	4.50	1310	4824	—	649	-71

WATER BUREAU OF
SOUTHERN DISTRICT

Subject RESERVOIR NO. 2 FOR FLOOD
ROUTING COMPUTATION
Computer S. E. M. Checked by _____

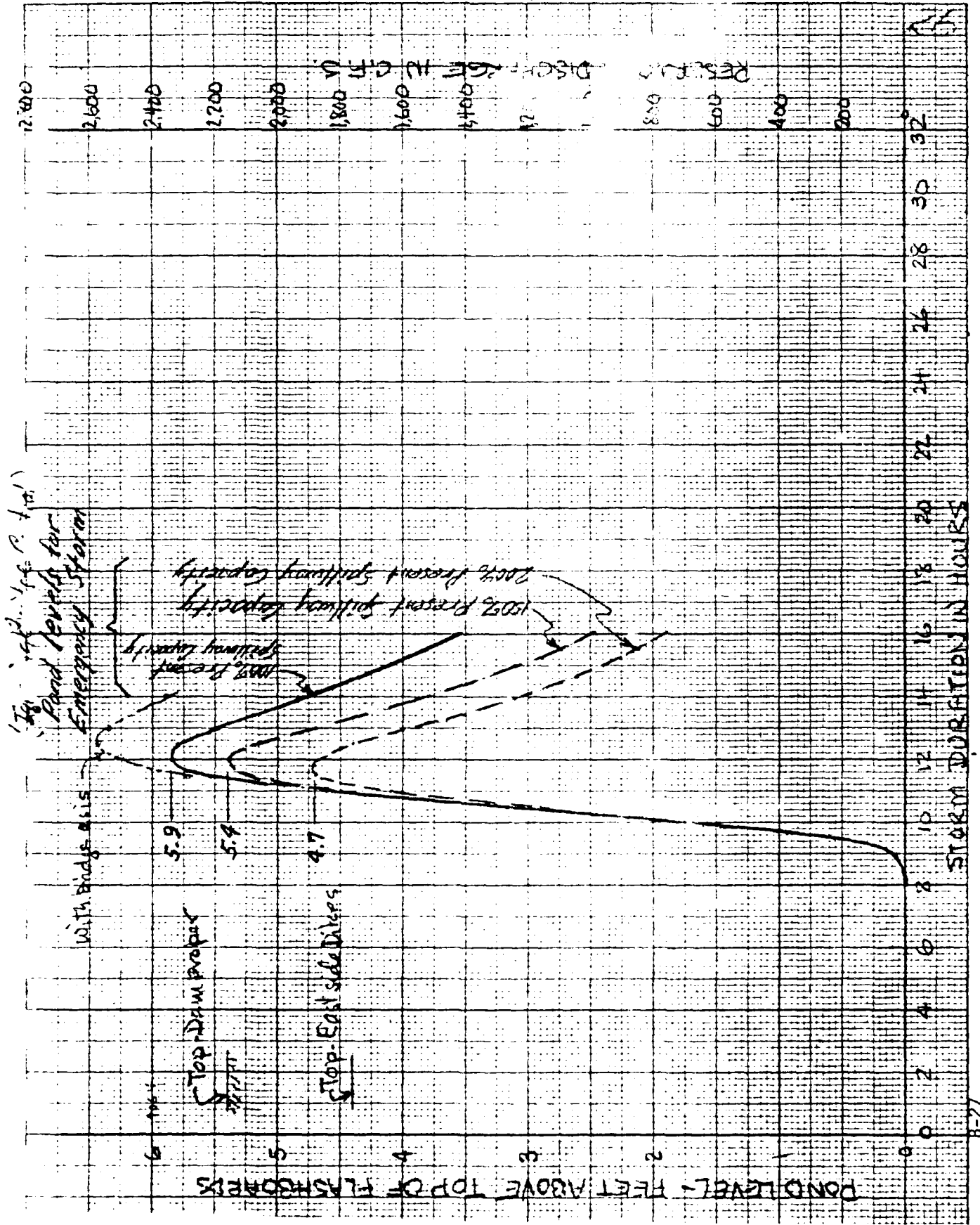
File No. _____
Acc. No. H-354.118 (14)
Date April 1964



Subject RESERVOIR 190.0 - 400.0 ft. elevation
Routing with Various Spillway Capacities

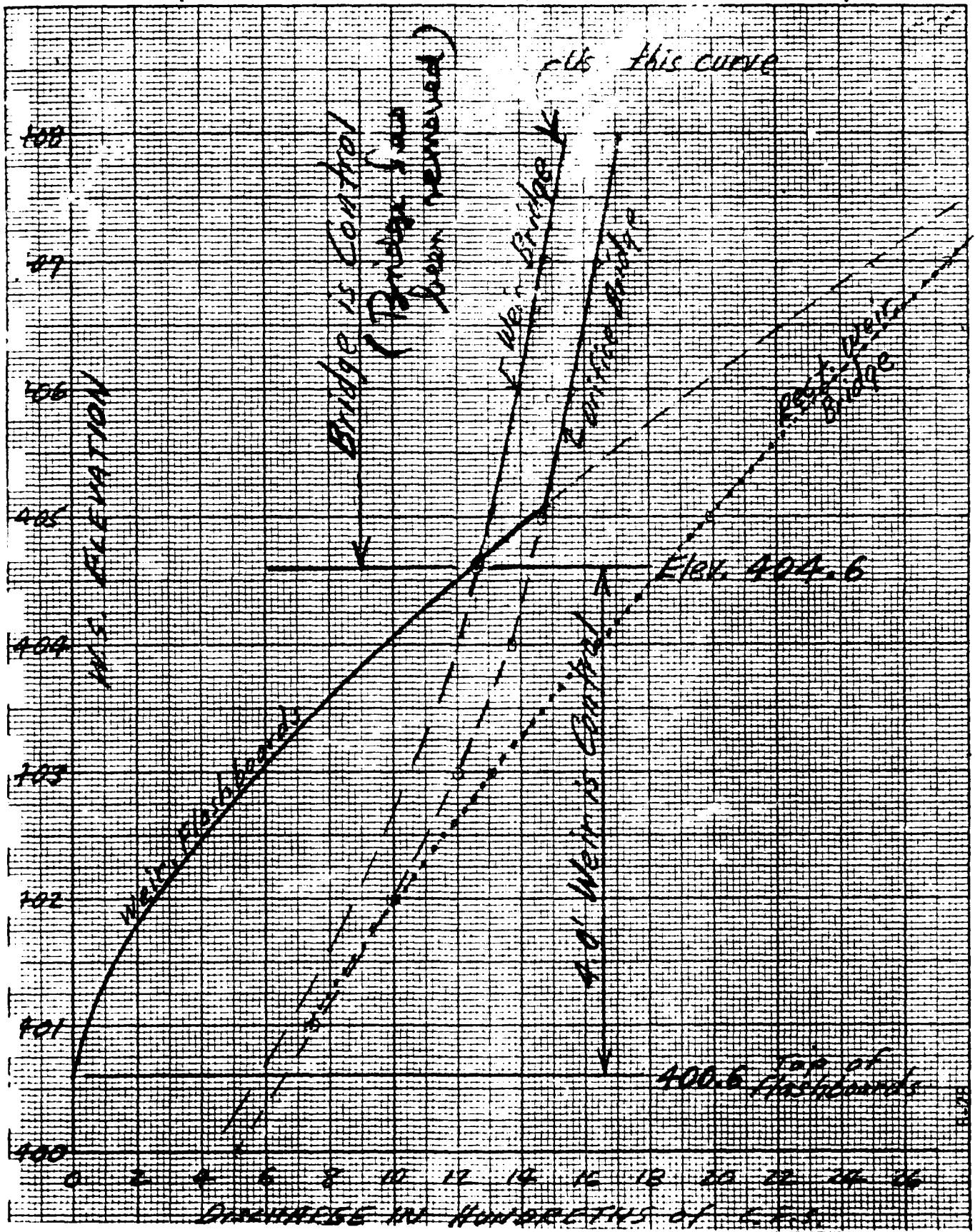
Computer _____ Checked by _____

File No. _____
Acc. No. H-3546.117
Date _____



Subject RESERVOIR NO. 6 FOR FLOOD
Routing Computations
Computer L.E. 711 Checked by _____

File No. _____
Acc. No. H-3546.115
Date April 1964



No. 1111-8

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

CT 5

Inventoried
By WPS

Date 6 MAY 1964

Long. 72° - 46' - 56" W
Lat. 41° - 1' - 28" N

Name of Dam or Pond HARTFORD RESERVOIR #6

Code No. C472 NP77 FL04 JS12 TM47

Nearest Street Location ROUTE 44

Town WEST HARTFORD

U.S.G.S. Quad. AVON

Name of Stream TUMBLE BROOK

Owner METROPOLITAN DISTRICT COMMISSION

Address 115 BROAD STREET

HARTFORD

OK
1/7/73

Pond Used For WATER SUPPLY 136

Dimensions of Pond: Width 700 FEET Length 8000 FEET Area ~~440~~ ACRES

Total Length of Dam 4800 FEET? Length of Spillway 48 FEET

Location of Spillway ~~EAST EDGE OF ROAD~~ north end of dike

Height of Pond Above Stream Bed ~~1 FEET~~ 27'

Height of Embankment Above Spillway ~~1 FEET~~ 8'

Type of Spillway Construction CONCRETE (OVERFLOW SECTION)

Type of Dike Construction EARTH, RIP-RAP UPSTREAM

Downstream Conditions WOODS

Summary of File Data _____

Remarks TREES GROWING ON DIKE. SPILLWAY IS IN

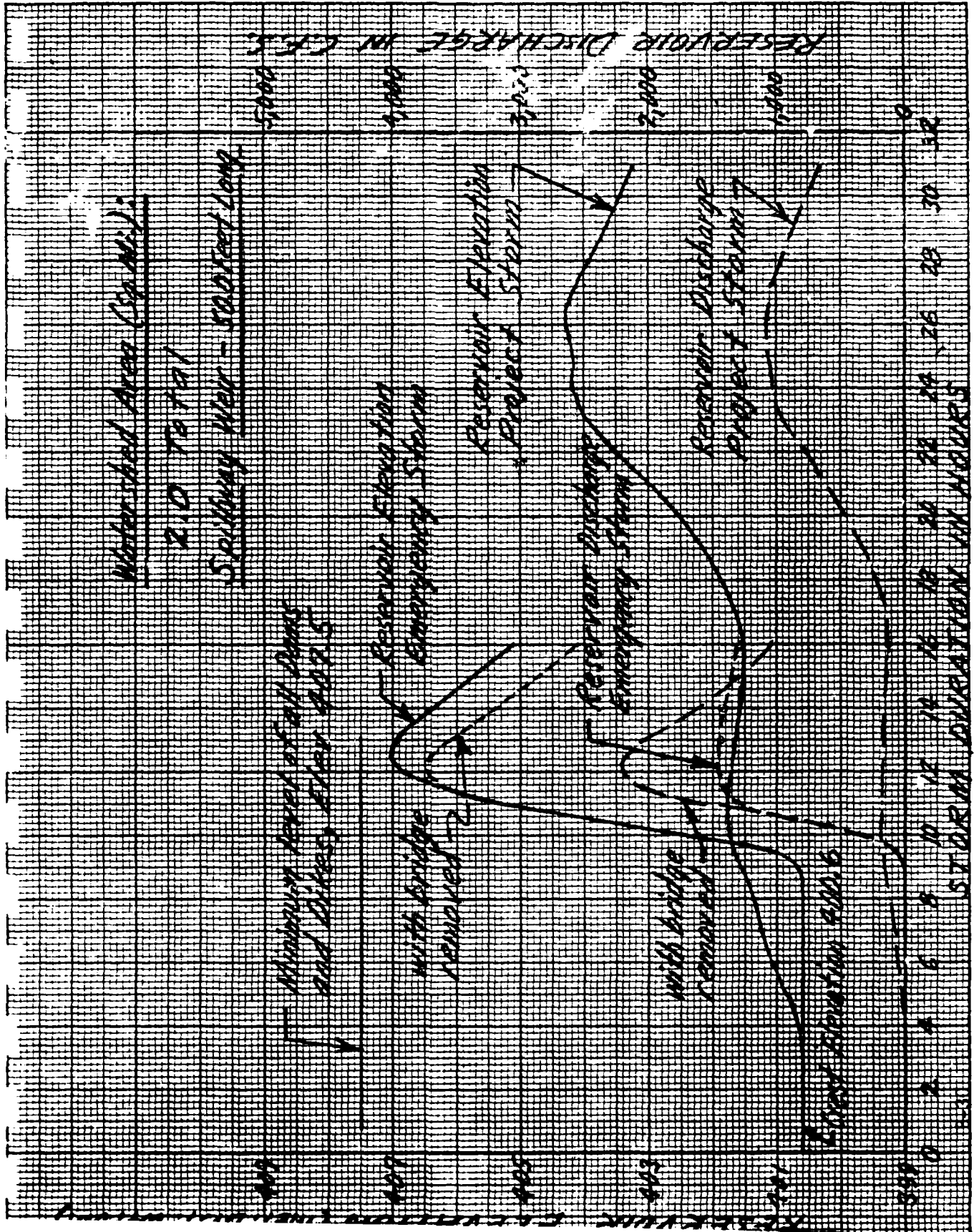
BLOOMFIELD, MAIN DIKES ARE IN WEST HARTFORD

10/14/73 2' of splash boards in place. Many trees are on dike
face should be cut. Dam appears safe AB

Would Failure Cause Damage? YES Class B

Subject RESERVOIR No. 6 - Hydrological
Results of Design Storms
Computer R. E. M. Checked by _____

File No. 5111
Acc. No. H-3546.12
Date JUNE 1964



BUREAU OF METROPOLITAN DISTRICT ENGINEERING OFFICE	SUBJECT Reservoir No. 6 - Recommended		FILE No.
	Improvements		Acc. No. H-3546.120
	COMPUTER <i>WJ</i>	CHECKED BY	DATE June 1964

Discussion -

Under present conditions, the weir will control the discharge rate up to about 1,200 cfs, requiring a head of about 4 feet on the flashboards. There would be little, if any, increase in peak discharge capacity if the 12 inch flashboards were removed since the discharge coefficient would tend to decrease and offset the greater head (on the lower crest).

With discharges in excess of 1,200 cfs required, the present bridge becomes the control; reducing a pure spillway flow of some 8,800 cfs to 1,500 cfs with pond level at 407.5. The bridge, however, is indispensable until the proposed new filter access road is complete.

For the emergency storm, the reservoir level will climb to Elev. 407.0 with the present bridge which will require raising the dams and dikes to Elev. 407.5 with about 8,500 cubic yards of fill.

If the bridge is removed, the reservoir level will peak at Elev. 406.5 which will require raising the dams and dikes to Elev. 407.0 with about 6,000 cubic yards of fill.

Recommendation -

- 1) Raise all dams and dikes to Elev. 407.5 which will safely contain the emergency storm with the present bridge as is.
- 2) Construct a concrete abutment on the southeast (low) side of the weir to contain the dike fill in the event the bridge abutments are overtopped and scour occurs.
- 3) After the new filters are completed, rediscuss the desirability of removing the present bridge, in which case an additional 0.5 - 1.0' freeboard will be available and thus increase the safety factor against loss of the dam.

RESERVOIR STATISTICS	Unit Watershed	Res. No. 6	Res. No. 2	Res. No. 5	Res. No. 3	Res. No. 1
Independent watershed Area	1.00 Sq. mi.	2.00 Sq. mi.	0.45 Sq. mi.	0.30 Sq. mi.	0.60 Sq. mi.	1.00 Sq. mi.
Receives Spillway Discharge from Upstream Reservoirs as Noted	—	None	Talbot (SCS)	No. 2	None	Nos. 3, 5 & South (SCS)
Proposed Level of Top of Dams & Dikes	—	El. 407.5	El. 392.0	El. 327.0	El. 398.5	— ϕ
Proposed Spillway Crest Level	—	El. 400.6	El. 387.6	El. 321.8	El. 393.3*	— ϕ
Surcharge Storage - Acrefeet/foot	—	135	42	24	24	26
<u>PROJECT STORM</u>						
Total Rainfall	18.24"					
Storm Duration	34 hrs					
Maximum One-Hour Rainfall	1.61"					
Maximum Run-Off Rate (Independent area)	900 cfs	1,880 cfs	590 cfs	270 cfs	520 cfs	900 cfs
Maximum Inflow Rate		1,880 cfs	620 cfs	690 cfs	520 cfs	1,960 cfs
Maximum Reservoir Level		El. 404.2	El. 389.6	El. 324.3	El. 397.2*	— ϕ
Maximum Discharge Rate		1,080 cfs	440 cfs	670 cfs	420 cfs*	— ϕ
<u>EMERGENCY STORM</u>						
Total Rainfall	18.24"					
Storm Duration	24 hrs					
Maximum One-Hour Rainfall	1.61"					
Maximum Run-Off Rate (Independent area)	2,900 cfs	5,960 cfs	1,930 cfs	880 cfs	1,730 cfs	5,970 cfs
Maximum Inflow Rate		5,960 cfs	1,980 cfs	2,110 cfs	1,730 cfs	6,190 cfs
Maximum Reservoir Level		El. 407.0	El. 391.6	El. 326.5	El. 398.1*	— ϕ
Maximum Discharge Rate		(2,200 cfs) 1,460 cfs	1,300 cfs	1,770 cfs	1,730 cfs*	— ϕ

Notes: All elevations are referred to Met. Dist. Datum.
(SCS) Indicates Flood Detention Reservoirs
presently being built by the Soil Conservation Service.

* Reservoir No. 3 discharges include flows
over bituminous surfaced emergency spillway with
crest at El. 396.5.

ϕ Present discharge capability of Res. No. 1
is approximately 3,500 cfs over existing spillway
crest at El. 258.6. No revisions are proposed
at this time due to the need for additional field
information and engineering study (currently
in progress).

* Peak discharge if spillway bridge is ever
removed or washed out.

PROJECT STORM - The reservoir proposals
are based on passing this storm with
normal freeboard for wave and wind
action. The storm is basically a repeat
of the August 1955 storm, as it occurred
over Westfield, Mass., relocated to occur
over the West Hartford reservoirs.

EMERGENCY STORM - The reservoir proposals
are based on passing this storm with
nominal freeboard. The storm is arbitrary
and synthetic consisting of a 3-hour
rainfall total of 13.55" (3/4 of maximum
possible), preceded and followed by
light rainfall.

Trim line for CS-14 Series 10/65

The Metropolitan District
Hartford County, Connecticut
Water Bureau
Designing Division

RECEIVED BY:
MAY 7 1979
CAHN ENGINEERS

Des. Div. Ref. No. S- 1412
Date 10/20/78

INSPECTION OF DAMS AND SPILLWAYS

NAME OF DAM Reservoir #6 South Dam

LOCATION (Town, River, Reservoir) West Hartford

<u>INSPECTORS</u>	<u>Name</u>	<u>Title</u>	<u>Div./Dept.</u>
	<u>Dave Layman</u>	<u>Ass't Engineer</u>	<u>Design</u>
	<u>Dick Conopask</u>	<u>Sr. Engineer</u>	<u>Design</u>
	<u></u>	<u></u>	<u></u>
	<u></u>	<u></u>	<u></u>

In filling out this form, please enter full information on conditions, and on location of any defects.

A. GENERAL

- 1) Were any photographs taken of the dam during this inspection Yes
- 2) Reservoir level, Elev. Depth above effluent pipe - 26.80'
- 3) Weather (including comment on humidity) Cool, dry, sunny beautiful Fall day

B. EARTH DAMS

- 1) Note any depressions in crest None
- 2) Slides and/or erosion, upstream face None - some large rip-rap missing - should be replaced - see picture #1 in 1973 report
- 3) Slides and/or erosion, downstream face None - 4± wookchuck holes
- 4) Cracks in embankment None

- 5) Surfacing on crest and condition Gravel - excellent
- 6) Condition of parapet walls, if any None
- 7) Seepage on downstream face, especially at toe, (location and quantity)
See 8 below
- 8) Soft ground at toe (locate) Standing water - see #8 in 1973 report
- 9) Signs of settlement at gate house and/or gate house bridge —
- 10) Downstream drainage system (clear or blocked, etc.) Road culvert O.K. - ends need clearing, see picture #3
- 11) Type and condition of downstream face planting Grass and brush slightly overgrown - Remove cedar tree, see picture #1
- 12) Is planting and/or debris etc. a fire hazard? No
- 13) Do plantings obscure toe of dam and other points where monitoring inspection is necessary? No
- 14) Damage or vandalism (to lights, plaques, etc.) —
- 15) Other —

C. CONCRETE DAMS

- 1) Any signs of motion —

.1. OVERALL ASSESSMENTS

Is this dam with its appurtenances maintained in a condition satisfactorily
to the Inspectors? Yes, however slopes could be debrushed and mown more
often

The Metropolitan District
Hartford County, Connecticut
Water Bureau
Designing Division

RECEIVED BY:
MAY 7 1979
CAHN ENGINEERS

Des. Div. Ref. No. S- 1412
Date 10/20/78

INSPECTION OF DAMS AND SPILLWAYS

NAME OF DAM Reservoir #6 Long East Dike

LOCATION (Town, River, Reservoir) West Hartford and Bloomfield

INSPECTORS

Name	Title	Div./Dept.
<u>Dave Layman</u>	<u>Ass't Engineer</u>	<u>Design</u>
<u>Dick Conopask</u>	<u>Sr. Engineer</u>	<u>Design</u>
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>

In filling out this form, please enter full information on conditions, and on location of any defects.

A. GENERAL

- 1) Were any photographs taken of the dam during this inspection Yes
- 2) Reservoir level, Elev. Depth above effluent pipe - 26.80'
- 3) Weather (including comment on humidity) Cool, sunny, dry tremendous
Fall day

B. EARTH DAMS

- 1) Note any depressions in crest None
- 2) Slides and/or erosion, upstream face None
- 3) Slides and/or erosion, downstream face None
- 4) Cracks in embankment None

- 5) Surfacing on crest and condition Gravel - excellent; oiled gravel
@ north end - good
- 6) Condition of parapet walls, if any ---
- 7) Seepage on downstream face, especially at toe, (location and quantity)
None
- 8) Soft ground at toe (locate) None
- 9) Signs of settlement at gate house and/or gate house bridge ---
None
- 10) Downstream drainage system (clear or blocked, etc.) None
- 11) Type and condition of downstream face planting Brush, trees and grass,
see picture #1; wood chips and junipers @ north end
- 12) Is planting and/or debris etc. a fire hazard? No
- 13) Do plantings obscure toe of dam and other points where monitoring inspection is necessary? No
- 14) Damage or vandalism (to lights, plaques, etc.) Littering
- 15) Other ---

C. CONCRETE DAMS

- 1) Any signs of motion ---

2) Deterioration noted:

Upstream face _____
 Downstream face _____
 Road/walk on crest _____
 Parapets _____
 Spillway _____
 Other (excluding gate houses) _____

3) Inspection Gallery:

General condition _____
 Leakage _____
 Lime accumulation _____
 Flooding & drainage _____
 Other _____

4) Damage or vandalism (to lights, plaques, etc.) _____

5) Other comments _____

D. INTAKE HOUSESi) Upper House

1) Exterior: walls _____ Excellent
 windows _____ Good - air rifle damage to several
 doors _____ Excellent
 roof _____ Excellent

2) Superstructure Interior:

walls Excellentfloor Excellentceiling Excellent3) Leakage into superstructure None

4) Substructure, interior: North sluice gate chamber *

Leakage and condensation —

Condition of metal work (stairs, etc.) Alum. ladder and cage - pitted, supports corroded (attached directly to concrete); pipe hangers corroded away - see pictures #5 through #8

5) Equipment condition:

Sluice gates 84" x 84" Upper level north side gate has broken stem - investigation underway, see pictures #9 and #10

Gate valves O.K.Piping Not inspectedElectrical gear O.K.Other _____6) Do all electric lights work Yes7) Condition of stop logs in storage well Excellent - minimal leakage into north chamber

8) Operating personnel comments on functional condition of all equipment (valves, hoists, selector gates, trash racks, screens, etc.) O.K.
except for broken sluice gate stem mentioned above

* South sluice gate chamber not inspected. North chamber before and after traveling screen - concrete excellent; ladders, safety cages and pipe supports corroded although aluminum is not as bad as that in North sluice gate chamber, see pictures #11 and #12, 10'± water in bottom of all chambers inspected. South chamber before and after traveling screen not inspected.

- 9) Last time various wells and other underwater portions were unwatered and examined (Give name of well and date in case of multiple wells).

North chambers - 10/78 (this inspection)

South chambers - ?

- 10) Other comments Thoroughly clean and inspect all ladder and cage supports -
replace pipe supports as necessary

fi) Lower House

- 1) Exterior: walls _____
 windows _____
 doors _____
 roof _____
- 2) Superstructure Interior:
 walls _____
 floor _____
 ceiling _____
- 3) Leakage into superstructure _____
- 4) Substructure, interior:
 Leakage and condensation _____
 Condition of metal work (stairs, etc.) _____
- 5) Equipment condition:
 Sluice gates _____
 Gate valves _____

Electrical gear _____

Other _____

6) Do all electric lights work _____

7) Condition of stop logs in storage well _____

8) Operating personnel comments on functional condition of all equipment
(valves, hoists, selector gates, trash racks, screens, etc.) _____

9) Other comments _____

iii) Conduit between gate houses

1) Concrete condition _____

2) Leakage _____

3) Condition of metal work and piping _____

4) Other comments _____

E. PRINCIPLE SPILLWAY

(If spillway is part of dam, enter information in C only).

1) Weir Excellent - see picture #2

- 2) Channel Approach to pipes - excellent
- 3) Outlet of channel Excellent
- 4) Note any obstructions to flow None
- 5) Bridge —
- 6) Is water spilling No
- 7) Other comments _____

F. EMERGENCY SPILLWAY

- 1) Channel _____
- 2) Obstructions _____
- 3) Other comments _____

G. APPURTENANT STRUCTURES

List structure (such as stilling pools, discharge weir structures, stream diversion works, etc. and give conditions.

Tunnel outfall - excellent but minor erosion at channel's end,

see picture #3

H. OVERALL ASSESSMENTS

Is this dam with its appurtenances maintained in a condition satisfactory to the Inspectors? Yes, however brush and trees on dam should be

thinned and aluminum ladders and steel pipe supports in wells of

Intake House should be thoroughly cleaned and replaced in necessary

The Metropolitan District
Hartford County, Connecticut
Water Bureau
Designing Division

RECEIVED BY:
MAY 7 1979
CAHN ENGINEERS

Des. Div. Ref. No. S- 1412
Date 10/20/78

INSPECTION OF DAMS AND SPILLWAYS

NAME OF DAM Reservoir #6 Small East Dike

LOCATION (Town, River, Reservoir) West Hartford

<u>INSPECTORS</u>	Name	Title	Div./Dept.
	<u>Dave Layman</u>	<u>Ass't Engineer</u>	<u>Design</u>
	<u>Dick Conopask</u>	<u>Sr. Engineer</u>	<u>Design</u>
	<u> </u>	<u> </u>	<u> </u>
	<u> </u>	<u> </u>	<u> </u>

In filling out this form, please enter full information on conditions, and on location of any defects.

A. GENERAL

- 1) Were any photographs taken of the dam during this inspection Yes
- 2) Reservoir level, Elev. Depth above effluent pipe - 26.80'
- 3) Weather (including comment on humidity) Cool, clear, dry, sunny
lovely Fall day

B. EARTH DAMS

- 1) Note any depressions in crest None
- 2) Slides and/or erosion, upstream face None, however some rip rap is
weathering
- 3) Slides and/or erosion, downstream face None
- 4) Cracks in embankment None

- 5) Surfacing on crest and condition Gravel - excellent (See picture #1)
- 6) Condition of parapet walls, if any —
- 7) Seepage on downstream face, especially at toe, (location and quantity)
None at toe
- 8) Soft ground at toe (locate) extensive swamp behind dike (road embankment)
- 9) Signs of settlement at gate house and/or gate house bridge —
- 10) Downstream drainage system (clear or blocked, etc.) Inlet - clear;
outlet overgrown - should be cleared, see picture #2
- 11) Type and condition of downstream face planting grass and light brush -
good to excellent
- 12) Is planting and/or debris etc. a fire hazard? No
- 13) Do plantings obscure toe of dam and other points where monitoring inspection is necessary? No
- 14) Damage or vandalism (to lights, plaques, etc.) Littering
- 15) Other —

C. CONCRETE DAMS

- 1) Any signs of motion —

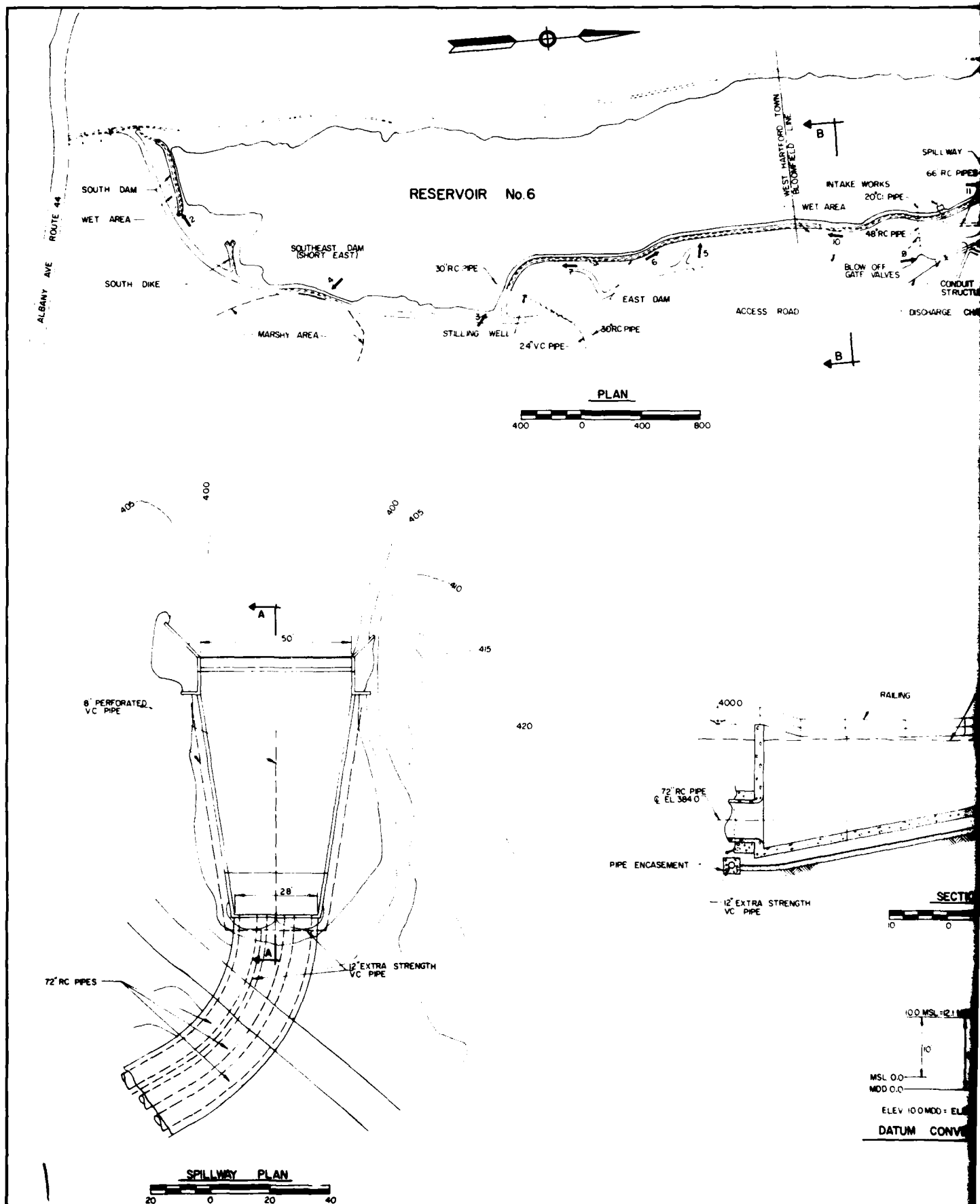
8.

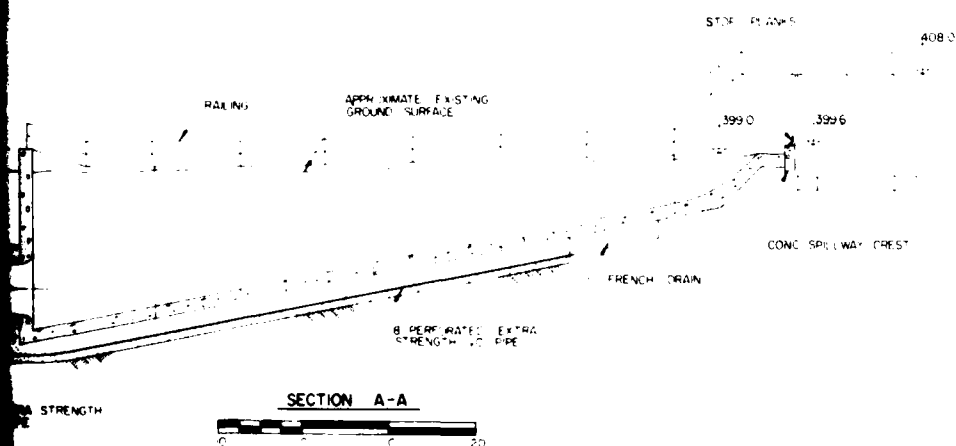
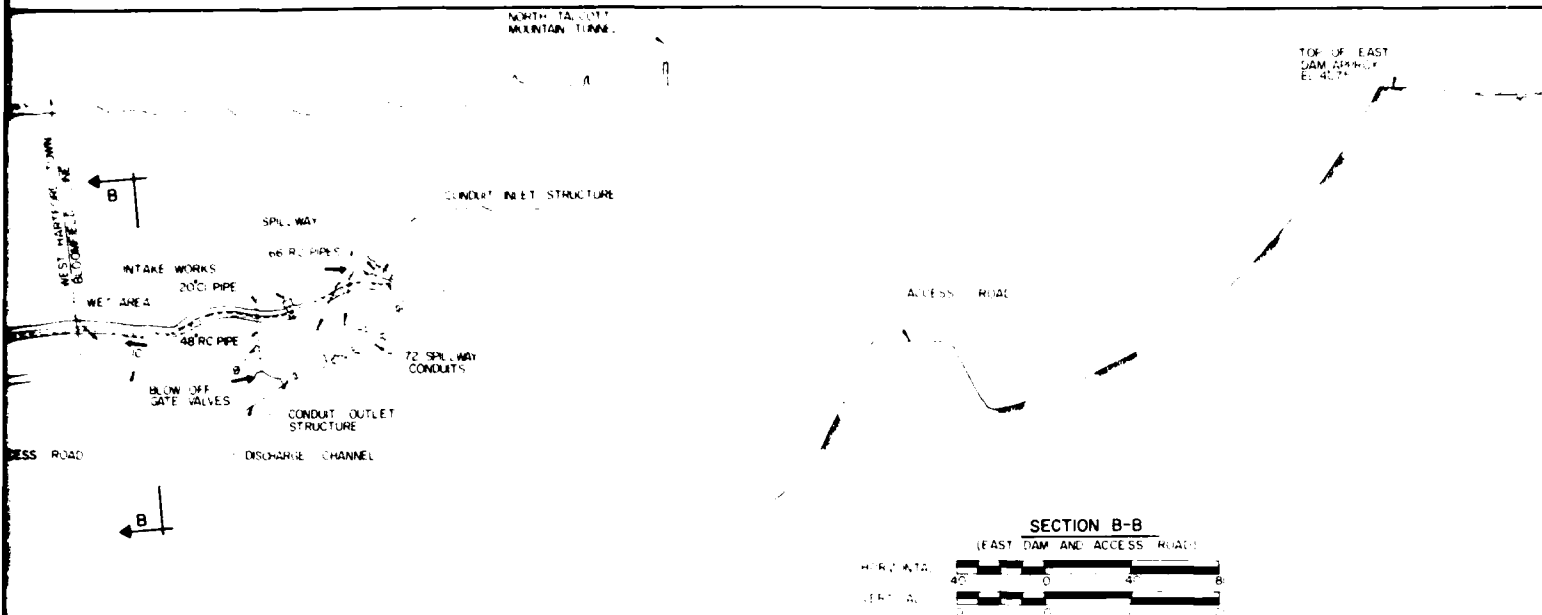
H. OVERALL ASSESSMENTS

Is this dam with its appurtenances maintained in a condition satisfactorily
to the Inspectors? Yes

APPENDIX C

DETAIL PHOTOGRAPHS





NOTES:

THIS PLAN WAS COMPILED FROM A GENERAL PLAN OF THE DAM ON A SHEET ENTITLED "RESERVOIR EXHAUSTION PLANT ACCESS ROAD - DRAWING AND APPURTENANCES, GENERAL AND LOCALITY PLANS" BY THE METROPOLITAN DISTRICT WATER BUREAU, DATED 1964, AND FROM A SET OF PLANS ENTITLED "RESERVOIR NO. 6 WATER TREATMENT PLANT, STAGE 1, WATER BUREAU CONTRACT 1963" BY BUCK, SEBERT AND JOIST CONSULTING ENGINEERS, DATED FEBRUARY 1968.

2 ELEVATIONS SHOWN ARE METROPOLITAN DISTRICT DATUM, WHICH IS 2.1 FEET BELOW THE MEAN SEA LEVEL DATUM, MSL. A GRAPHIC REPRESENTATION OF THE CONVERSION IS INCLUDED ON THIS PLAN.

X 2 PICTURE NUMBER AND APPROXIMATE DIRECTION

CAHN ENGINEERS INC. WALLINGFORD, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.
---	---

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS
PHOTOGRAPH LOCATION PLAN

HARTFORD RESERVOIR No. 6

TR-TUMBLE BROOK BLOOMFIELD, WEST HARTFORD, CONNECTICUT

DRAWN BY	CCH	CHECKED BY	PAH	APPROVED BY	SCALE AS NOTED
DATE	JUNE 1979	PLATE	2-A		



PHOTO 1 - Aerial view of South Dam and access road. Note gravel road along crest of dam.

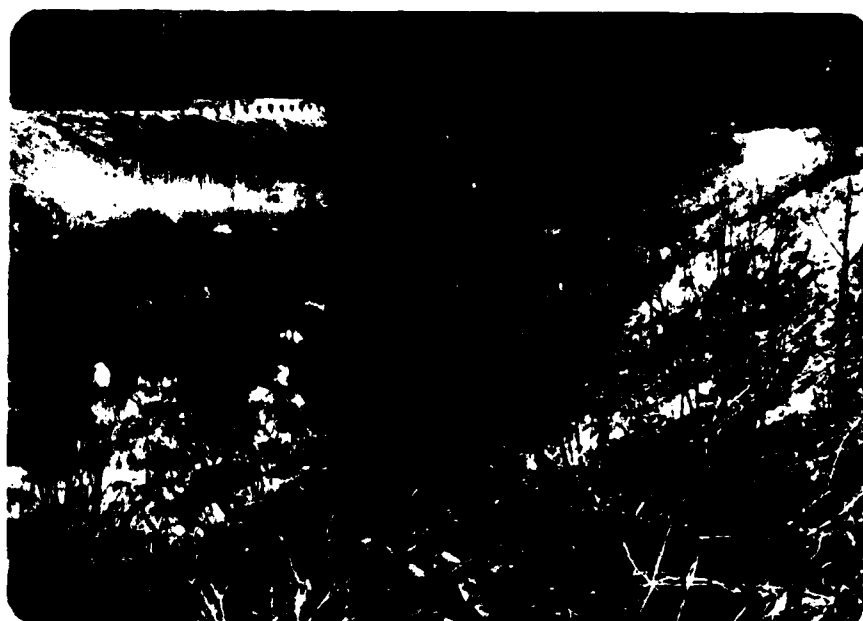


PHOTO 2 - Downstream slope of South Dam and wet area between dam and access road.

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	HARTFORD RES. NO. 6 DAM TR - TUMBLE BROOK
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER		BLOOMFIELD- W. HTFD, CT. CE# 27 595 KB DATE June, '79 PAGE C-1



PHOTO 3 - View of portion of crest and upstream slope of East Dam from right abutment. Riprap and crest typical of all dam.



PHOTO 4 - Loss of riprap due to weathering of sandstone blocks.

US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

CAHN ENGINEERS INC.
WALLINGFORD, CONN.
ENGINEER

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

HARTFORD RES. NO. 6 DAM
TR - TUMBLE BROOK
BLOOMFIELD-W. HTFD, CT.
CE# 27 595 KB
DATE June, '79 PAGE C-2



PHOTO 5 - Minor area of erosion along footpath on downstream slope of East Dam. Note drop off of approximately one foot at toe where road has been cut into slope.



PHOTO 6 - Uprooted tree stump and resultant minor cavitation on downstream slope of East Dam.

US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

CAHN ENGINEERS INC.
WALLINGFORD, CONN.
ENGINEER

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

HARTFORD RES. NO. 6 DAM
TR - TUMBLE BROOK
BLOOMFIELD- W HFTD, CT.
CE# 27 595 KB
DATE June '79 PAGE C-3

AD-A142 565

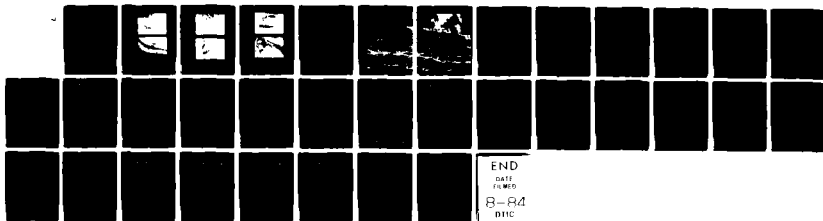
NATIONAL DAM INSPECTION PROGRAM HARTFORD RESERVOIR
NUMBER 6 EAST DAM (CT...) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUN 79

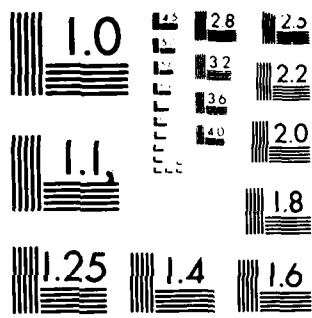
2/2

UNCLASSIFIED

F/G 13/13

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



PHOTO 7 - Numerous cedar trees on downstream slope of East Dam and unimproved road at toe of slope.

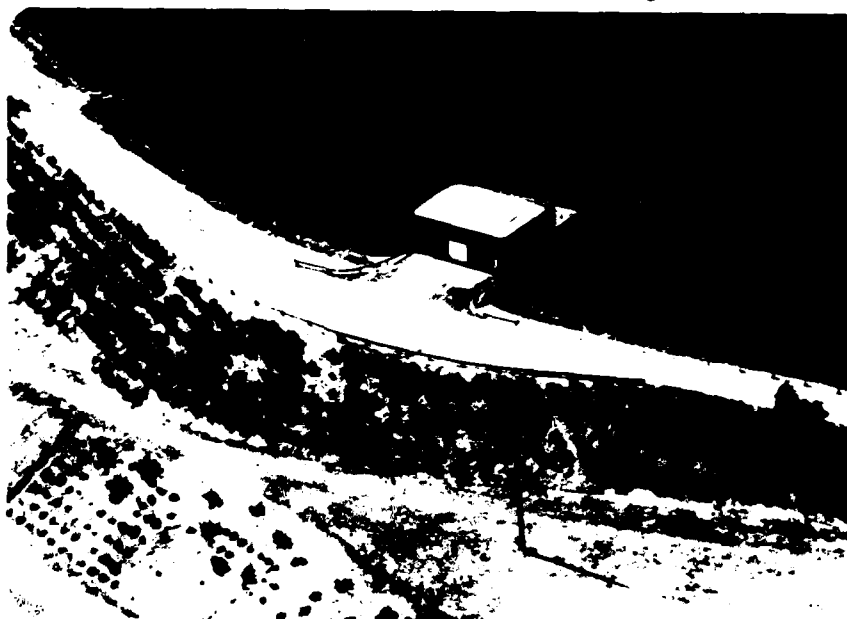


PHOTO 8 - Aerial view of gatehouse and downstream slope of East Dam where shrubs have been planted.

US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

CAHN ENGINEERS INC.
WALLINGFORD, CONN.
ENGINEER

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

HARTFORD RES. NO. 6 DAM
TR - TUMBLE BROOK
BLOOMFIELD- W. HTFD, CT.
CE# 27 595 KB
DATE June '79 PAGE C-4



PHOTO 9 - 48" blowoff outlet pipe at downstream toe of East Dam. Note tree blocking outlet.

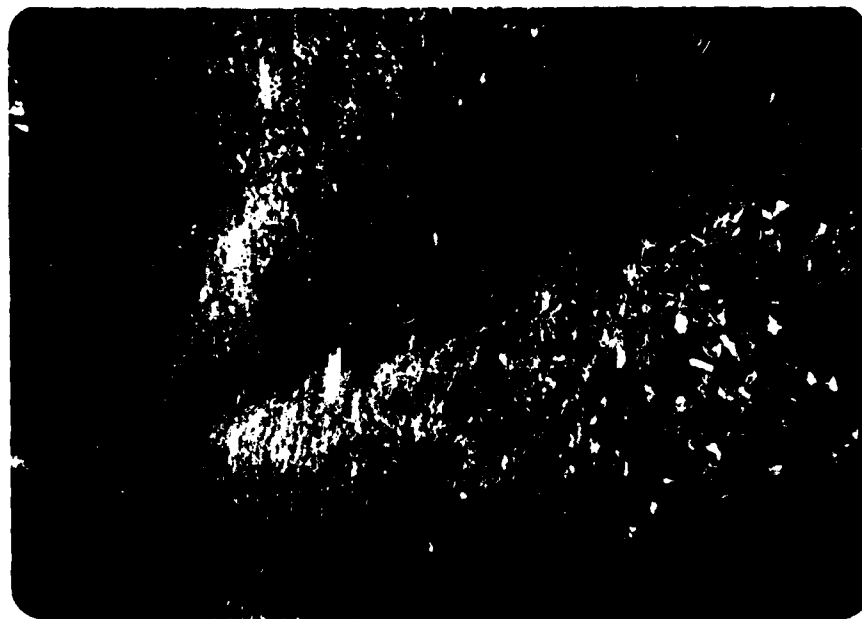


PHOTO 10 - Wet area at toe of East Dam.

US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

CAHN ENGINEERS INC.
WALLINGFORD, CONN.
ENGINEER

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

HARTFORD RES. NO. 6 DAM
TR - TUMBLE BROOK
BLOOMFIELD- W. HTFD, CT.
CE# 27 595 KB
DATE June '79 PAGE C-5

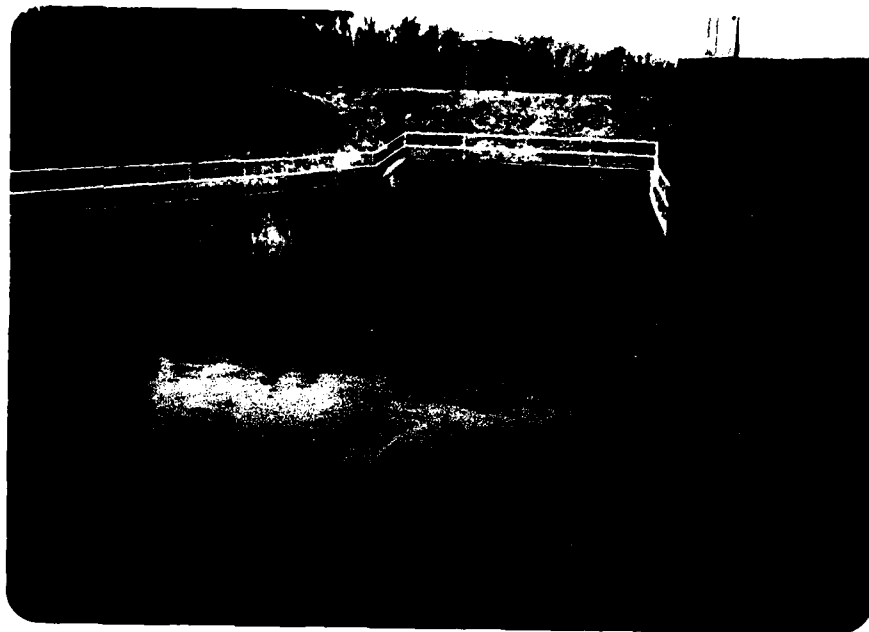


PHOTO 11 - Concrete spillway structure and three 72" reinforced concrete conduits.

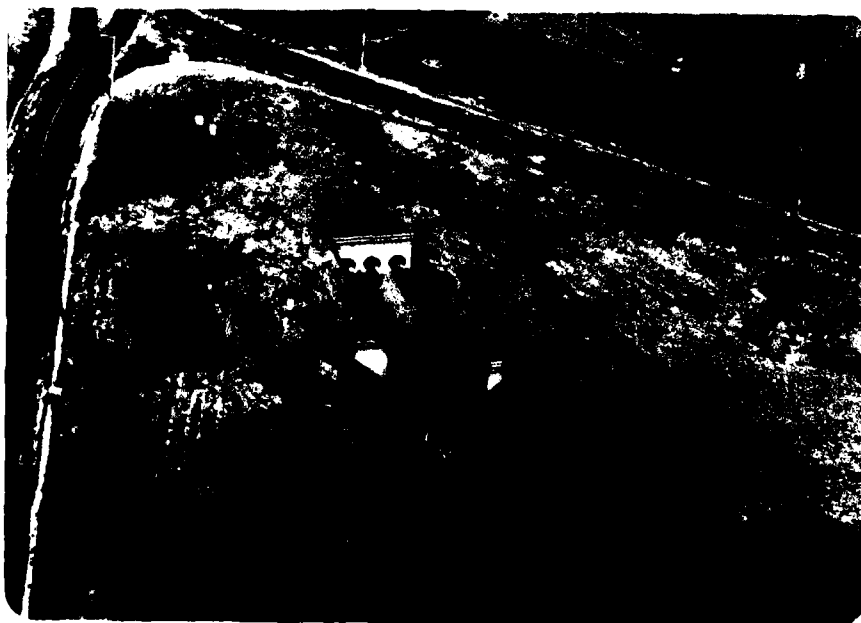


PHOTO 12 - Concrete stilling basin and headwall structures for flow from spillway, storm drainage and from filtration plant.

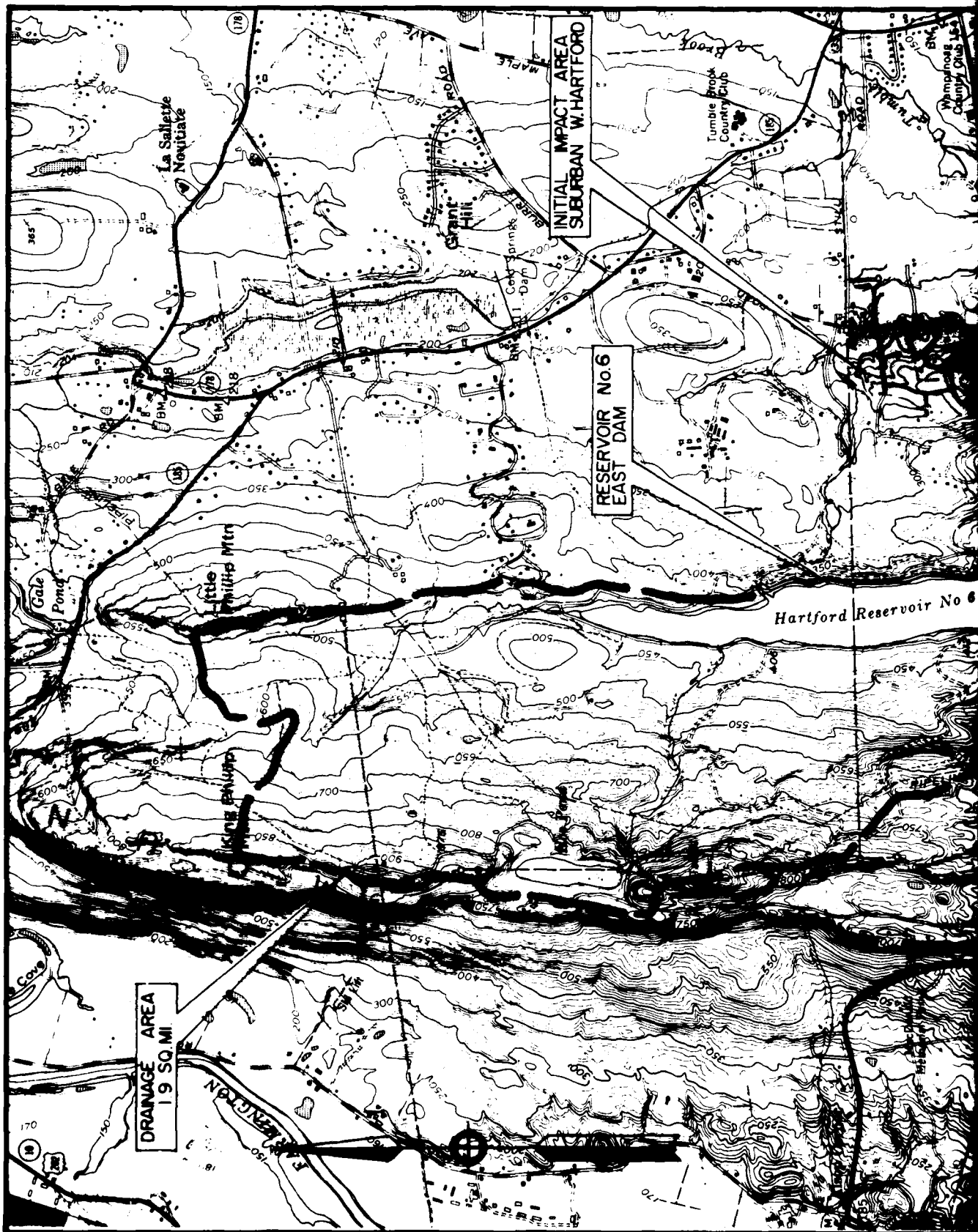
US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

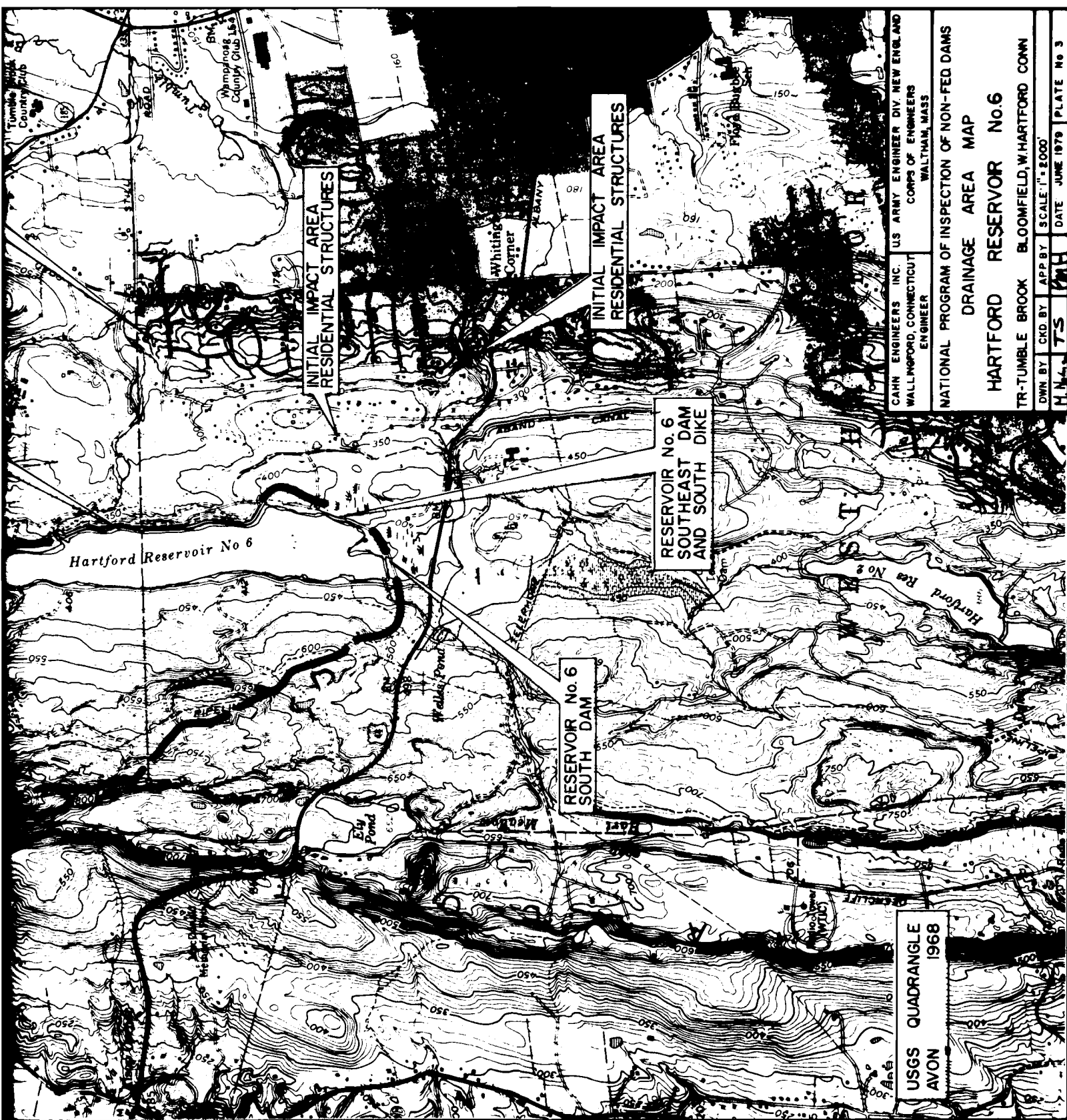
CAHN ENGINEERS INC.
WALLINGFORD, CONN.
ENGINEER

NATIONAL PROGRAM OF
INSPECTION OF
NON-FED. DAMS

HARTFORD RES. NO. 6 DAM
TR - TUMBLE BROOK
BLOOMFIELD- W. HTPD, CT.
CE# 27 595 KB
DATE June '79 PAGE C-6

APPENDIX D
HYDRAULICS/HYDROLOGIC COMPUTATIONS





USGS QUADRANGLE
AVON
1968

CAHN ENGINEERS INC.
WALLINGFORD, CONNECTICUT
ENGINEER

US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

DRAINAGE AREA MAP

HARTFORD RESERVOIR No.6

TR-TUMBLE BROOK BLOOMFIELD, W. HARTFORD CONN

DWN BY: CKD BY: APP BY: SCALE: 1" = 2000'

DATE: JUNE 1979

PLATE No. 3

Cahn Engineers Inc.

Consulting Engineers

Project INSPECTION OF NON-FEDERAL DAMS IN NEW ENGLAND
Computed By HRP Checked By TS
Std Book Ref. _____ Other Refs. CE #27-595-KB

Sheet 1 of 18
Date 4/3/19
Revisions _____

HYDROLOGIC / HYDRAULIC INSPECTION

HARTFORD RESERVOIR NO. 6, BLOOMFIELD / WEST HARTFORD, CT.

I) PERFORMANCE AT TEST FLOOD CONDITIONS:

1) MAXIMUM PROBABLE FLOOD

a) WATERSHED CLASSIFIED AS "ROLLING"

b) WATERSHED AREA: $DA = 1.9 \text{ sq mi}$

NOTE: DATA FROM U.S.G.S., HARTFORD OFFICE AND FROM FILES OF THE HARTFORD METROPOLITAN DISTRICT AS FOLLOWS: 1) THE ORIGINAL "RESERVOIR NO. 6" MAP, DATED 1895: $DA = 1.82 \text{ sq mi}$; 2) HYDROLOGICAL ANALYSIS, MD. ACC. H-3456: $DA = 2.0 \text{ sq mi}$; 3) MD. ACC H-2771.2 $DA = 2.84 \text{ sq mi}$ (CONSIDERED TO BE IN ERROR). C.E. CHECK: $DA = 1.9 \text{ sq mi}$.

A TUNNEL DIVERSION FROM THE NEPAUG AND BARNHAMSTEAD RESERVOIRS IS CONTROLLED (GATED) AND CAN BE STOPPED IF NECESSARY BY THE METROPOLITAN DISTRICT. THEREFORE, NO RUN-OFF FROM THIS DIVERSION WILL BE CONSIDERED FOR THIS COMPUTATIONS.

c) FROM NED-ACE "PRELIMINARY GUIDANCE FOR ESTIMATING MAX. PROBABLE DISCHARGES" GUIDE CURVE FOR PMF-PEAK FLOW RATES EXTRAPOLATION TO $DA'S < 2 \text{ sq mi}$.

$$PMF = 2200 \text{ cfs/sq mi}$$

d) PEAK INFLOW: $PMF = 2200 \times 1.9 = 4200 \text{ cfs}$

Gahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION

Sheet 2 of 18

Computed By HLL

Checked By TS

Date 4/3/19

Field Book Ref. _____

Other Refs. CE # 21-59-KB

Revisions _____

HARTFORD RESERVOIR NO 6 DAMS

1. (Cont'd) PERFORMANCE AT TEST FLOOD CONDITIONS

2) SPILLWAY DESIGN FLOOD (SDF):

a) CLASSIFICATION OF DAM ACCORDING TO NED-ACE RECOMMENDED GUIDELINES:

c) SIZE: STORAGE (MAX) ≈ 3500 AC-FT ($1000 < S < 50000$ AC-FT)
HEIGHT (EAST) $\approx 42'$ ($25 < H < 40$ ft)

STORAGE: FROM THE ORIGINAL "RESERVOIR NO 6" MAP, DATED 1895, CAPACITY TO 27 FT DEPTH $S_{27} \approx 765.1$ MG; ELEV. 27 CORRESPONDS TO W.L. ELEV. 400' ORDA (OLD RESERVOIR DATUM) $\approx 397.5'$ MSL; CAPACITIES TO THIS ELEV. AND TO THE PRESENT RESERVOIR FLOWLINE ELEV. 397.5' MSL (401' ORDA) ARE TABULATED IN MD. ACC. NO. H-2801 "WEST HARTFORD RESERVOIR CAPACITIES" DATED AUG. 31, 1956. CAP. TO FLOWLINE $S_{FL} = 809.1$ MG ≈ 2480 AC-FT. FROM THE SAME RES. NO 6 MAP AND MD. INVENTORY DATA SHEET, LAKE AREA AT FLOWLINE $A \approx 141$ AC.; C.E. MEAS. AREA AT (\pm) ELEV. 405.4' MSL (TOP OF DAM) $A = 165$ AC. \therefore AVE AREA ≈ 153 AC. AND MAX. STORAGE $\approx 2480 + 6.9 \times 153 = 3536$, SAY, 3500 AC-FT

HEIGHT: RES. NO. 6 ACTUALLY IS FORMED BY A NUMBER OF DAMS OF VARIOUS LENGTHS AND HEIGHTS: 1) SOUTH DAM: $H \approx 14'$ (C.E. FROM METROPOLITAN DISTRICT TOPOGRAPHIC MAP OF RESERVOIR, 1" = 200'; 2' CONTOURS) 2) SOUTH DINE/SOUTHWEST DAM: $H \approx 12'$; AND 3) EAST DAM WITH (1) $H \approx 42'$. IT IS NOTED THAT THE HEIGHT OF THE EAST DAM IS NOT CLEARLY DEFINED BECAUSE OF THE CONSIDERABLE EARTHWORK THAT HAS BEEN MADE ALONG THE P'S FACE OF THE DAM FOR ROADS AND OTHER STRUCTURES, SINCE IT WAS ORIGINALLY BUILT. MD. RES. NO 6 DATA SHEET SETS THE DAM HEIGHT AT $H = 30'$. HOWEVER, SOME SECTIONS OF THE DAM SHOW FAIRLY PARALLEL CONTOURS AS IF PART OF THE EMBANKMENT AT LEAST TO ELEV. 366' MDD (METROPOLITAN DISTRICT DATUM) ≈ 363.9 MSL SETTING $H \approx 42'$

Gahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION

Sheet 3 of 18

Computed By YLL

Checked By TS

Date 4/3/79

Field Book Ref. _____

Other Refs. CER 57-595-KB

Revisions _____

HARTFORD RESERVOIR NO. 6 DAMS

2.2-Cont'd) CLASSIFICATION

(i) HAZARD POTENTIAL: THE VARIOUS DAMS FORMING RESERVOIR No. 6 ARE LOCATED FROM (±) 1000' TO 2000' $\frac{1}{2}$ S OF LARGE URBANIZED SECTIONS OF WEST HARTFORD. IMMEDIATE IMPACT AREAS UPON FAILURE OF RESERVOIR NO. 6 DAMS ARE CONSIDERED THE AREA NEAR MOUNTAIN ROAD AT THE BORDER BETWEEN BLOOMFIELD AND WEST HARTFORD ($\frac{1}{2}$ S FROM EAST DAM) AND THE AREA NEAR ALBANY AVE, WEST FROM MOUNTAIN ROAD ($\frac{1}{2}$ S FROM SOUTH AND SOUTHEAST DAM). FURTHER, OTHER ISOLATED HOUSES, CLOSER TO THE RESERVOIR, ALONG FERN-CLIFF AND WESTCLIFF DRIVES MAY BE AFFECTED UPON FAILURE OF SPECIFIC PORTIONS OF ANY ONE OF THE DAMS.

(ii) CLASSIFICATION:

SIZE: INTERMEDIATE

HAZARD: HIGH

b) $SDF = PMF \approx 4200 \text{ CFS}$

$\frac{1}{2} PMF \approx 2100 \text{ CFS}$

3) SURCHARGE AT PEAK INFLOWS:

a) PEAK INFLOW: $Q_p = 4200 \text{ CFS}$

$Q_p' = \frac{1}{2} PMF = 2100 \text{ CFS}$

b) SPILLWAY (OUTFLOW) RATING CURVE:

i) SPILLWAY:

THE RESERVOIR NO. 6 SPILLWAY IS ACTUALLY A LOW BEDD CRESTED SILL (±) 0.5' HIGHER THAN THE APPROACH CHANNEL BOTTOM AT THE $\frac{1}{2}$ S FACE OF THE SILL. THE APPROACH CHANNEL IS (±) 90' LONG

D-3

Cahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION

Sheet 4 of 18

Computed By WLL

Checked By T.S.

Date 4/5/79

File Book Ref

Other Refs. CE # 77-595-KB

Revisions

HARTFORD RESERVOIR NO. 6 DAMS

3.6-Cont'd) OUTFLOW RATING CURVE

SET AT AN ADVERSE SLOPE OF $(\pm) 3.75\%$. THE SILL AND THE CHANNEL ARE $(\pm) 50'$ WIDE. ON THE SILL CREST, STOP PLANKS (NOT FLASH DAMS) ARE INSTALLED, RAISING THE ACTUAL CREST ELEVATION OF THE OUTFLOW WEIR BY $12"$ TO ELEV. $398.5'$ MSL ($400.6'$ MDD $\approx 401'$ ORD). THE SPILLWAY DISCHARGES DIRECTLY INTO THE INLET STRUCTURE OF A $3-72"$ RCP CONDUIT, $(\pm) 760'$ LONG, WHICH CARRIES THE SPILLWAY OUTFLOW UNDER THE GROUNDS OF THE RESERVOIR NO. 6 WATER TREATMENT PLANT. THE ACTUAL CONDUIT INLET IS $(\pm) 86'$ FROM THE SILL, AT INVERT (\pm) ELEV. $378.9'$ MSL ($381'$ MDD). THE TOP ELEV. OF THE HEADWALL AND SIDEWALLS OF THE STRUCTURE CONNECTING THE SPILLWAY AND THE CONDUITS VARY. THE MINIMUM TOP ELEVATION OF THESE WALLS BEING (\pm) ELEV. $395.9'$ MSL ($398'$ MDD). HOWEVER, THE GROUND AROUND THE INLET STRUCTURE CLOSES THE INLET TO APPROX. ELEV. $(\pm) 405.9'$ MSL ($408'$ MDD) OR (\pm) THE TOP ELEV. OF THE DAM AND SPILLWAY SIDEWALLS. THE INVERT ELEV. AT THE CONDUIT OUTLET IS $(\pm) 346.1'$ MSL ($348.2'$ MDD). (SEE SKETCH P. 5 OF THESE COMPS.) THEREFORE, AT LARGE FLOWS, IF THE HEADWATER REQUIRED BY THE CONDUITS TO PASS THE SPILLWAY DISCHARGE EXCEEDS APPROXIMATELY THE ELEVATION OF THE SPILLWAY CREST ($398.5'$ MSL $\approx 400.6'$ MDD), THE SPILLWAY BECOMES SUBMERGED AND THE RESERVOIR W.L. WOULD BECOME INCREASINGLY MORE CONTROLLED BY THE CONDUITS THAN BY THE SPILLWAY. THE FLOW WILL CONTINUE TO BE CONTAINED WITHIN THE AREA SURROUNDING THE CONDUITS INLET UNTIL THE CONDUIT HEADWATER REACHES (\pm) THE TOP ELEV. OF THE DAM. AT (\pm) THIS ELEV. ($\approx 408'$ MDD) THE EXCESS FLOW TO THE MAX. CAPACITY OF THE SPILLWAY/CONDUIT SYSTEM, WILL OVERFLOW AROUND THE CONDUIT INLET STRUCTURE AS WELL AS OVER THE TOP OF THE VARIOUS DAMS FORMING THE RESERVOIR.

Cahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION

Sheet 5 of 18

Computed By HL

Checked By TS

Date 4/6/79

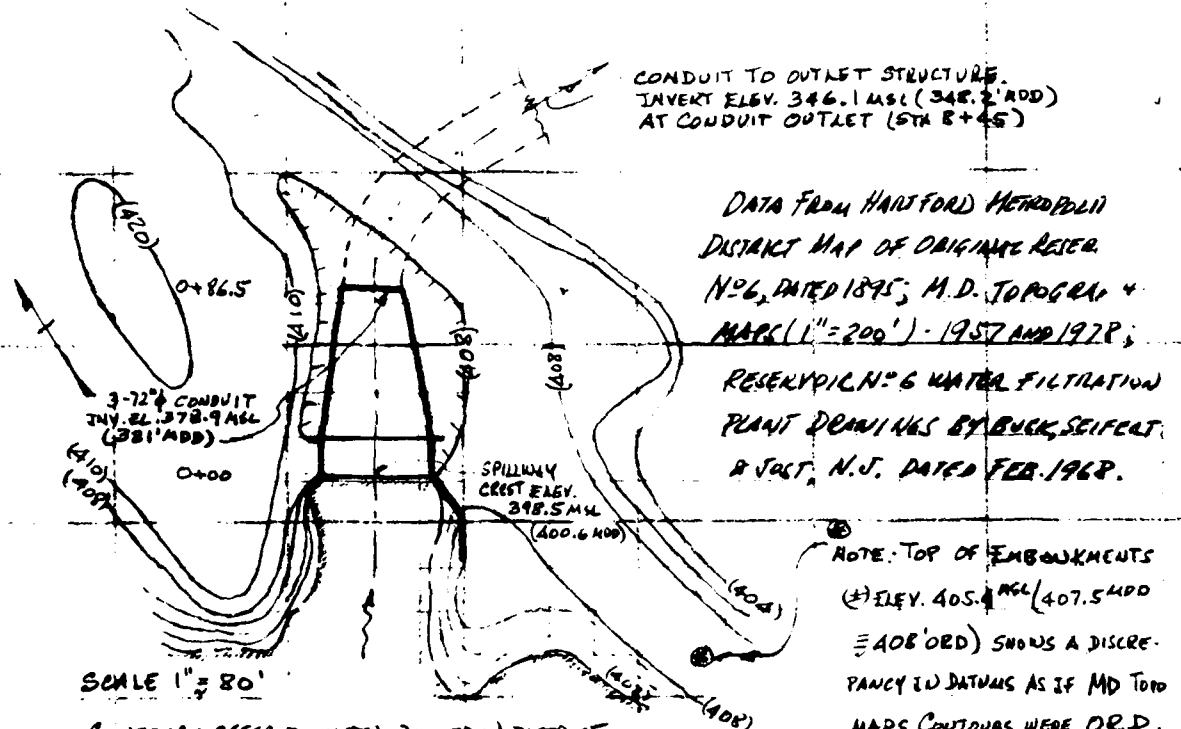
Field Book Ref

Other Refs CE# 21-595-KB

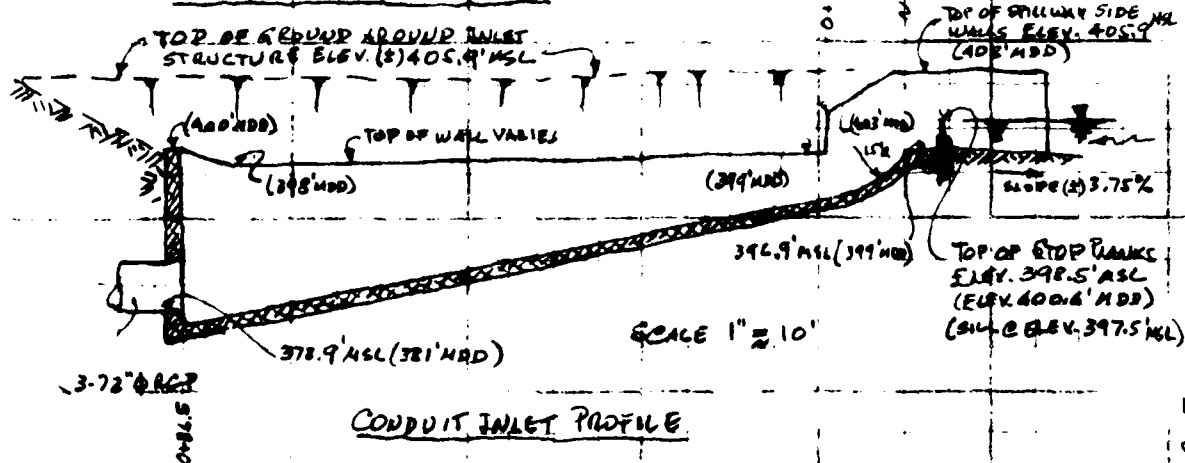
Revisions

HARTFORD RESERVOIR NO. 6 DAMS

3.6-Cont'd) OUTFLOW RATING CURVE



SPILLWAY & CONDUIT INLET



D-5

Glahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION

Sheet 6 of 18

Computed By HUR

Checked By TD

Date 4/10/79

Field Book Ref

Other Refs CE #27 590-KB

Revisions

HARTFORD RESERVOIR NO. 6 DAMS

3.2- (Cont'd.) OUTFLOW RATING CURVE

THEREFORE, ASSUME WEIR $C = 3.3$ OVER THE STOP PLANKS

USING THE TOP ELEVATION OF THE STOP PLANKS (ELEV. 398.5' MSL = 400.6' MFD) AS DATUM, THE SPILLWAY DISCHARGE UNSUBMERGED IS APPROXIMATED BY:

$$Q_s = 165 H^{3/2} \quad H = \left(\frac{Q_s}{165} \right)^{2/3}$$

FOR THE 3-72" ϕ RCP CONDUITS FLOWING FULL AND ASSUMING FREE FLOW DISCHARGE; $K_e = 0.2$ (WELL-ROUNDED ENTRANCE) AND $n = 0.014$ (72" ϕ FULL PIPE CONVEYANCE $*K_{14} = 39.30$); THE HEADWATER ELEV. REFERRED TO THE SAME DATUM (TOP ELEV. OF THE STOP PLANKS) CAN BE APPROXIMATED BY:

$$H_c = H - H_z = \left(\frac{1 + K_e}{2g A^2} + \frac{L}{K^2} \right) \left(\frac{Q}{3} \right)^2 - H_z \quad \text{(COND. BAND LOSSES ALLOWED FOR IN "n")}$$

WHERE $H_z = 400.6' - 351.2' = 49.4'$ IS THE DIFFERENCE IN ELEVATIONS BETWEEN THE ϕ OF THE OUTLET AND THE TOP OF THE STOP PLANKS. $A = 28.3$ SQ FT THE AREA OF ONE 72" ϕ PIPE. $L = 760'$ APPROX. THE CONDUIT LENGTH AND Q THE TOTAL DISCH.

$$H_c = 8.05 \times 10^{-6} Q^2 - 49.4$$

H_c COULD BE POSITIVE OR NEGATIVE DEPENDING ON WHETHER THE SPILLWAY (ABOVE STOP PLANKS) IS SUBMERGED OR NOT. ACTUALLY, ONLY POSITIVE VALUES OF H_c INDICATING SUBMERGENCE OF THE SPILLWAY WILL BE OF INTEREST IN THIS ANALYSIS. I.E., FOR SPILLWAY DISCHARGES $Q \geq 3490$ CFS

Jahn Engineers Inc.

Consulting Engineers

Object NON-FEDERAL DAMS INSPECTION
Computed By HLL Checked By TS
Field Book Ref. _____ Other Refs. CE # 27-595-KB

Sheet 7 of 18
Date 4/12/79
Revisions _____

HARTFORD RESERVOIR NO. 6 DAMS

3.6 - (Cont'd) OUTFLOW RATING CURVE

THEREFORE, THE CONDUIT CAPACITY WILL START CONTROLLING THE RESERVOIR OUTFLOW FOR SURCHARGES ABOVE

$$H_* = \left(\frac{2480}{165} \right)^{3/2} = \underline{6.1'}$$

THE TOP OF THE EMANKMENTS IS AT ^{MSL} ELEV. 405.4' (407.5' ^{MSL}) AND FOR SURCHARGES BETWEEN 6.1' AND 6.9' THE SPILLWAY WILL DISCHARGE WITH CAPACITY PARTIALLY REGULATED BY SUBMERGENCE FROM THE CONDUIT INLET. ABOVE A SURCH. OF 6.9', OVERTOPPING WILL BEGIN.

SPILLWAY CAPACITY WITHIN THE SUBMERGED RANGE CAN BE APPROXIMATED BY THE VILLEMONT'S EQUATION:

$$\frac{Q}{Q_1} = \left[1 - \left(\frac{H_2}{H_1} \right)^{1.5} \right]^{0.385} \text{ OR, } \frac{Q_2}{Q_1} + \left(\frac{Q}{Q_1} \right)^{2.60} = 1$$

WHERE Q_1 AND Q_2 ARE FREE FLOW DISCHARGES UNDER THE HEADS H_1 AND H_2 ($1/5$ AND $4/5$ FROM THE SPILLWAY) AND Q IS THE ACTUAL DISCHARGE FOR SUBMERGED FLOW CONDITIONS.

THE SOLUTION OF THE ABOVE EQUATION FOR THE SUBMERGENCE PRODUCED BY THE CONDUIT TO PASS THE FLOW GIVES FOR A HEAD $H_1 = 6.9'$ $1/5$ THE SPILLWAY (MAX. SURCHARGE TO TOP OF DAM), A FLOW $Q = 2560^{CFS}$ AND A $4/5$ SUBMERGENCE $H_2 = 3.3'$, I.E. ALMOST NO VARIATION IN FLOW OVER THE 0.8' SURCHARGE INCREASE, ($Q_1 = 2990^{CFS}$ SPILLWAY CAPACITY $4/5$ SUBMERGENCE @ $H_1 = 6.9'$). FOR SPILLWAY SURCHARGES $H_1 \geq 6.9'$ THE RESERVOIR NO. 6 DAMS ARE OVERTOPPED ($Q \geq 2560^{CFS}$) THE CONDUIT INLET STILL HAVING (+) 3.6' FREEBOARD.

Cahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION

Sheet 8 of 18

Computed By HU

Checked By TS

Date 4/17/74

Field Book Ref. _____

Other Refs. CE #21-575-KB

Revisions _____

HARTFORD RESERVOIR NO 6 DAMS

3,6 - Cont'd) OUTFLOW RATING CURVE

ii) EXTENSION OF RATING CURVE FOR SURCHARGE HEADS ABOVE TOP OF DAMS

ALL THE EMBANKMENTS OF THE DAMS FORMING RESERVOIR NO 6 HAVE TOP ELEV. (+) 405.4' MSL (407.5' MDD \approx 408' ORD). THE LENGTH OF THE DAMS AT THIS ELEVATION IS AS FOLLOWS:

SOUTH DAM = 550'
SOUTHEAST DAM = 1000' (INCL. SOUTH DIKE)
EAST DAM = 3500' (EXCL. SPILLWAY)
TOTAL L = 5050'

EACH ONE OF THE DAMS TIES AT BOTH SIDES TO SLOPING TERRAIN GENERALLY COVERED WITH LARGE DECIDUOUS AND EVERGREEN TREES. THUS, A TOTAL OF 6 SLOPING SIDES, 3 ON (+) 9" TO 1" SLOPE; 2 ON (+) 17" TO 1" SLOPE AND 1 ON 5" TO 1" SLOPE CLOSE THE 3 DAMS MAIN SECTIONS TO THE ADJACENT TERRAIN.

AN ADDITIONAL LENGTH OF (+) L = 270' AROUND THE INTAKE AT ELEV. (+) 405.4' MSL (407.5' MDD) ADDS TO THE OVERTOPPED LENGTH OF THE DAMS IF THE HEADWATER AT THE CONDUIT INTAKE REACHES THE ELEVATION OF THE TOP OF THE DAM ($Q = 2650$ CFS THEN CORRECT).

ASSUME $C = 3.0$ FOR THE FLOW OVER THE EARTH EMBANKMENT
 $C = 2.5$ FOR THE OVERFLOW AT THE SIDES OF THE DAM

ASSUME, ALSO, EQUIVALENT LENGTHS FOR THE SLOPING TERRAIN AT THE SIDES OF THE DAM, AS FOLLOWS:

Object NON-FEDERAL DAMS INSPECTION
 Computed By HLL Checked By TS
 Field Book Ref. _____ Other Refs. CE #27-SIN-KB

Sheet 9 of 18
 Date 4/19/79
 Revisions _____

HARTFORD RESERVOIR NO 6 DAMS

3.6 - (Cont'd) OUTFLOW RATING CURVE

$$L'_1 = \frac{2}{3} \left(\frac{9}{1} \right) (H - 6.9) = 6(H - 6.9) \text{ FOR EACH OF THE } 3-9^\circ 1' \text{ SLOPES}$$

$$L'_2 = \frac{2}{3} \left(\frac{17}{1} \right) (H - 6.9) = 11.3(H - 6.9) \text{ FOR EACH OF THE } 2-17^\circ 1' \text{ SLOPES}$$

$$L'_3 = \frac{2}{3} \left(\frac{5}{1} \right) (H - 6.9) = 3.3(H - 6.9) \text{ FOR THE } 5^\circ 1' \text{ SLOPE}$$

THEREFORE, THE TOTAL EQUIVALENT LENGTH FOR THE SLOPING TERRAIN AT THE SIDES OF THE DAMS IS COMBINED AS FOLLOWS:

$$L'_T = 3L'_1 + 2L'_2 + L'_3 = \underline{\underline{44(H - 6.9)}}$$

THE TOTAL OVERFLOW RATING CURVE CAN BE APPROXIMATED BY:

$$Q = Q_s + \underbrace{3.0 \times 5050}_{(\sim 15200)} (H - 6.9)^{3/2} + \underbrace{2.5 \times 44}_{(\sim 110)} (H - 6.9)^{5/2}$$

WHERE Q_s IS THE SPILLWAY-CONDUIT AND CONDUIT INTAKE FLOW AND/OR OVERFLOW AS APPLICABLE FOR THE CORRESPONDING SURCHARGE DEPTH AND DEGREE OF SPILLWAY SUBMERGENCE.

THE TOTAL OVERFLOW RATING CURVE IS PLOTTED ON NEXT PAGE

Cahn Engineers Inc.

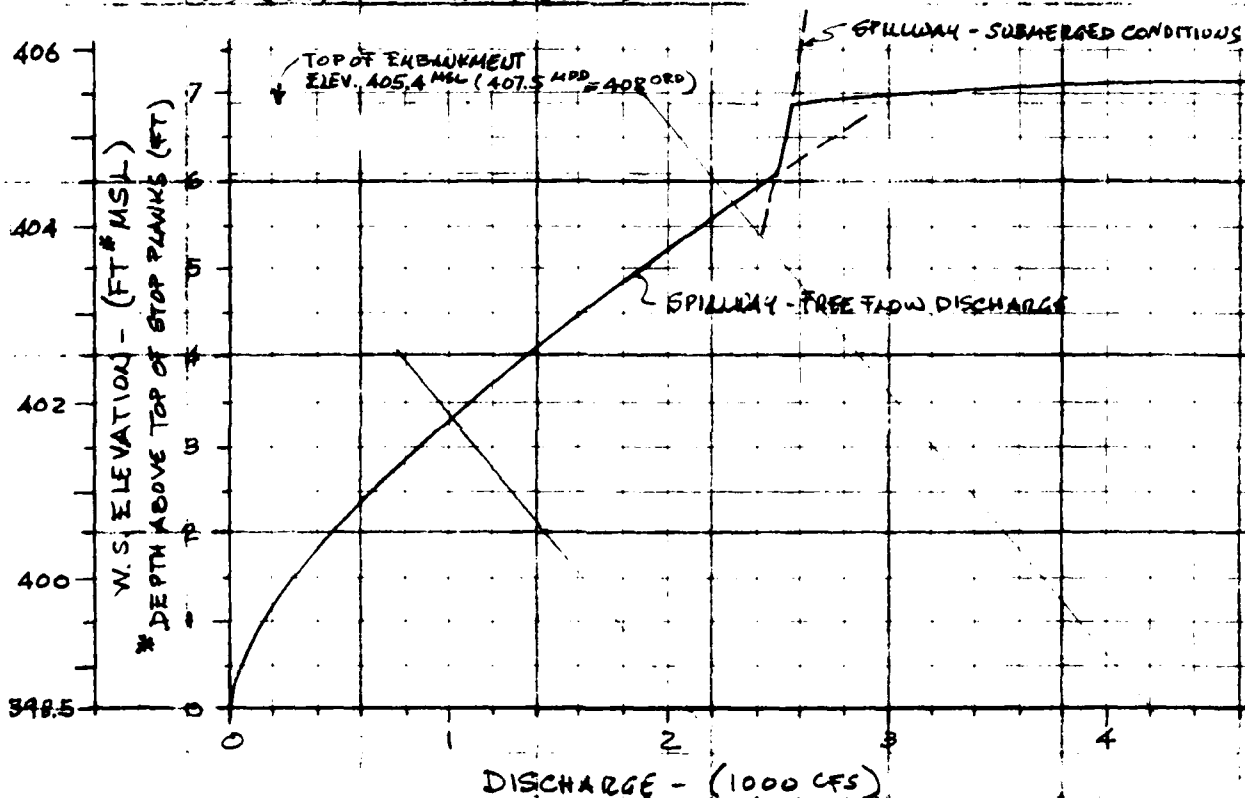
Consulting Engineers

Object NON-FEDERAL DAMS INSPECTION
 Computed By WHL Checked By TS
 Field Book Ref. _____ Other Refs. CE #27-59-KB

Sheet 10 of 18
 Date 4/19/79
 Revisions _____

HARTFORD RESERVOIR NO. 6 DAMS

3-Cont'd) OUTFLOW RATING CURVE



* NOTES: USCGS ELEVATIONS (MSL) ARE RELATED TO ELEVATIONS IN THE HARTFORD METROPOLITAN DISTRICT DATUM (MDD) AND THE OLD RESERVOIR DATUM (ORD) AS FOLLOWS:

$$MSL = MDD - 2.08' = ORD - 2.51'$$

DEPTH IS REFERRED TO TOP OF THE STOP PLANKS WHICH IS THE PRESENT SPILLWAY CREST ELEV. FOR THE DAM.

John Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION
 Prepared By HOL Checked By TS
 and Book Ref _____ Other Refs CE # 27-595-KB

Sheet 11 of 18
 Date 4/20/79
 Revisions _____

HARTFORD RESERVOIR No 6 DAMS

3-Cont'd) SURCHARGE AT PEAK INFLOW

c) SPILLWAY CAPACITY TO TOP OF DAM

$$H = 6.9' \therefore Q_s \approx 2560 \text{ cfs} \quad (\pm 61\% \text{ OF } Q_p; (\pm 122\% \text{ OF } Q_p')$$

NOTE: THE SPILLWAY IN THIS CASE IS OPERATING WITH PARTIAL SUBMER-
 GENCE ($H_2 \approx 3.3'$) CAUSED BY THE HEADWATER PRODUCED BY
 THE CONDUIT SYSTEM.

d) SURCHARGE HEIGHT TO PASS Q_p

$$i) @ Q_p = PMF = 4200 \text{ cfs} \quad H_s \approx 7.1'$$

$$ii) @ Q_p' = \frac{1}{2} PMF = 2100 \text{ cfs} \quad H_s' \approx 5.5'$$

A) EFFECT OF SURCHARGE ON MAX. PROBABLE DISCHARGES (OUTFLOW)

a) RESERVOIR (LAKE) AREA AT FLOW LINE: $*A_0 = 141 \text{ ac}$

ASSUME AVG. LAKE AREA WITHIN EXPECTED SURCHARGE, $*A \approx 153 \text{ ac}$

*SEE "STORAGE" NOTES ON PAGE 2 OF THESE COMPUTATIONS.

b) ASSUME NORMAL POOL LEVEL AT STOP PLANKS TOP ELEV. (EL. 398.5 MSL $\approx 400.6 \text{ MSL}$)

c) WATERSHED AREA: D.A. $\approx 1.9 \text{ sq mi}$ (SEE P. 1)

D-11

Cahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION
 Computed By HLL Checked By T.S.
 Field Book Ref. _____ Other Refs. CE # 27-595-HB

Sheet 12 of 18
 Date 4/20/79
 Revisions _____

HARTFORD RESERVOIR NO. 6 DAMS

4-Cont'd) EFFECT OF SURCHARGE STORAGE ON PEAK OUTFLOW

d) DISCHARGE (Q_P) AT VARIOUS HYPOTHETICAL SURCHARGE DEPTHS:

$$H=7' \quad V=7 \times 153 = 1071 \text{ AC-FT} \quad \therefore S = \frac{1071}{1.9 \times 53.3} = 10.58''$$

$$H=4' \quad V=612 \text{ AC-FT} \quad \therefore S = 6.04''$$

$$H=2' \quad V=306 \text{ AC-FT} \quad \therefore S = 3.02''$$

FROM APPROXIMATE STORAGE ROUTING NED-ACE GUIDELINES (19" MAX. PROB-
 ABLE R.O. IN NEW ENGLAND)

$$Q_P = Q_H \left(1 - \frac{S}{19}\right) \text{ AND FOR } 1/2 \text{ PMF: } Q'_P = Q'_H \left(1 - \frac{S}{9.5}\right)$$

FOR THE ABOVE HYPOTHETICAL SURCHARGES:

$$H=7' \quad Q_P = 1860 \text{ CFS}$$

$$H=4' \quad Q_P = 2860 \text{ CFS} \quad Q'_P = 764 \text{ CFS}$$

$$H=2' \quad Q_P = 1430 \text{ CFS}$$

$$(\text{ACTUALLY FOR } H=0; Q_P = 4200 \text{ CFS}; Q'_P = 2100 \text{ CFS})$$

e) PEAK OUTFLOW (Q_P)

USING NED-ACE GUIDELINES "SURCHARGE STORAGE ROUTING" ALTERNATE
 METHOD (SEE P. 10 OF THESE COMPS.)

Cahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION

Sheet 13 of 18

Computed By WHL

Checked By TS

Date 4/20/79

Field Book Ref. _____

Other Refs. CE# 27-595-KB

Revisions _____

HARTFORD RESERVOIR NO. 6 DAMS

A.C. (CON'D) PEAK OUTFLOW (Q_P)

$$Q_P = 2280 \text{ CFS} \quad H_3 = 5.8' \text{ FOR } Q_P = \text{PMF}$$

$$Q'_P = 1000 \text{ CFS} \quad H_3 = 3.3' \text{ FOR } Q'_P = \frac{1}{2} \text{ PMF}$$

f) SPILLWAY CAPACITY RATIO TO OUTFLOW:

SPILLWAY CAPACITY TO TOP OF DAMS: $Q_S = 2560 \text{ CFS}$

\therefore SPILLWAY CAPACITY IS (1) 112% THE OUTFLOW @ PMF
AND (2) 256% THE OUTFLOW @ $\frac{1}{2}$ PMF.

5) SUMMARY:

a) PEAK INFLOW: $Q_P = \text{PMF} = 4200 \text{ CFS}$ $Q'_P = \frac{1}{2} \text{ PMF} = 2100 \text{ CFS}$

b) PEAK OUTFLOW: $Q_P = 2280 \text{ CFS}$ $Q'_P = 1000 \text{ CFS}$

c) SPILLWAY MAX. CAPACITY: $Q_S = 2560 \text{ CFS}$ OR (1) 112% OF Q_P
AND (2) 256% OF Q'_P

THEREFORE, AT SDF = PMF, THE SPILLWAY WILL OPERATE AT FREE DISCHARGE TO AN AVE. SURCHARGE ABOVE THE TOP OF STOP PLANKS OF (1) 5.8' (WS' EL. 404.3' ASL) OR (2) 1.1' FREEBOARD TO TOP OF DAM. THE CONDUIT P/S WILL OPERATE WITH A HEADWATER (1) 7.5' BELOW TOP OF STOP PLANKS OR (2) EL. 391' ASL (I.E. (2) 5' FREEBOARD TO TOP OF THE INTAKE HEADWALLS). AT SDF = $\frac{1}{2}$ PMF THE SURCH. ABOVE TOP OF STOP PLANKS WILL BE (1) 3.3' OR (2) 3.6' FREEBOARD TO TOP OF DAM.

D-13

Project NON-FEDERAL DAMS INSPECTION
 Computed By HOU Checked By TS
 Field Book Ref. _____ Other Refs. CE # 37-595-KB

Sheet 14 of 18
 Date 4/20/79
 Revisions _____

HARTFORD RESERVOIR NO 6 DAMS

II) DOWNSTREAM FAILURE HAZARD

1) PEAK FLOOD AND STAGE AT IMMEDIATE IMPACT AREA.

DEPENDING UPON WHERE THE FAILURE OF RESERVOIR NO 6 DAMS MAY OCCUR, THREE POTENTIAL IMPACT AREAS (SEE "HAZARD POTENTIAL" P. 3 OF THESE COMPS) D/S FROM THE DAM CAN BE CONSIDERED.

(i) THE MOST IMMEDIATE IMPACT AREA ARE THE HOUSES ALONG WESTCLIFF AND FERNCLIFF DRIVES D/S FROM SOUTHEAST DAM AND THE RIGHT PORTION OF EAST DAM.

(ii) UPON FAILURE OF THE LEFT PORTION OF EAST DAM, THE IMMEDIATE IMPACT AREA WOULD BE THE URBANIZED AREA NEAR MOUNTAIN ROAD AT THE BORDER BETWEEN BLOOMFIELD AND WEST HARTFORD.

(iii) FAILURE OF THE SOUTHEAST AND SOUTH DAMS WILL AFFECT THE AREA NEAR ALBANY AVE. WEST FROM MOUNTAIN ROAD (WEST HARTFORD)

ALTHOUGH THE THREE IMPACT AREAS ARE INDEPENDENT FROM EACH OTHER, HAZARD/DAMAGE UPON FAILURE OF THE RESERVOIR AT THE IMPACT AREA (ii) IS CONSIDERED EQUAL TO OR HIGHER THAN FOR IMPACT AREAS (i) AND (iii). IMPACT AREA (i) ALTHOUGH CLOSER IS D/S OF LOWER PORTIONS OF EMBANKMENT AND IS LESS POPULATED THAN THE OTHER AREAS. THE FLOOD STAGE TO IMPACT AREA (iii) WILL BE PRODUCED UPON FAILURE OF RELATIVELY LOW EMBANKMENT AND WILL TRAVEL A LONGER CHANNEL (INCLUDING A SWAMP) BEFORE REACHING THE AFFECTED AREA.

Kahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION

Sheet 15 of 18

Computed By HLL

Checked By TS

Date 4/20/79

Field Book Ref

Other Refs CE# 37-595-KB

Revisions

HARTFORD RESERVOIR NO 6 DAMS

1-Cont'd) PEAK FLOOD AND STAGE AT IMMEDIATE IMPACT AREA

THEREFORE, DOWNSTREAM FAILURE ANALYSIS WILL BE MADE FOR IMPACT AREA (4C) - (MOUNTAIN ROAD AT THE BLOOMFIELD/WEST HARTFORD BOUNDARY) AS REPRESENTATIVE OF THE HAZARD POTENTIAL OF RESERVOIR NO 6.

a) BREACH WIDTH:

(EAST DAM). - ALTHOUGH THE EAST DAM IS AT THE TOP A CONTINUOUS EMBANKMENT (±) 300' LONG, THE FILL ACTUALLY CLOSES SEVERAL DEPRESSIONS BETWEEN A SERIES OF LOW HEIGHT HILLS OR PROMONTORIES. THEREFORE, HEIGHT AS WELL AS LENGTH AT MID-HEIGHT OF THE VARIOUS PORTIONS OF THE EMBANKMENT VARY. FURTHER, AS PREVIOUSLY EXPLAINED (SEE "HEIGHT" P. 2 OF THESE COMPS.), CONSIDERABLE EARTHWORK HAS BEEN MADE ALONG THE D/S FACE OF EAST DAM, MAKING DIFFICULT TO DEFINE THE PORTIONS THAT ARE ACTUALLY EMBANKMENT FROM THOSE THAT MAY BE ORIGINAL AND/OR WORKED GROUND. HOWEVER, BY FIELD OBSERVATIONS AND THE STUDY OF THE CONTOURS AT THE 1:200 SCALE METROPOLITAN DISTRICT MAP, THE HEIGHT, MID-HEIGHT AND MID-HEIGHT LENGTH HAVE BEEN ESTIMATED.

(C) MID-HEIGHT (±) ELEV. 384.4' MSL (386.5' MDD) $(107.5 \text{ AND } \frac{42}{2} = 386.5')$
*SEE P. 2 OF THESE COMPS.

(D) APPROX. MID-HEIGHT LENGTH $L = 480'$ (C.E. MEASURED ON MET. DIST. MAP)

NOTE: THIS LENGTH CORRESPONDS TO THE ESTIMATED LONGEST PORTION OF EMBANKMENT OF THE EAST DAM BETWEEN (APPARENTLY) NATURAL GROUND PORTIONS.

D-15

Glahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION

Sheet 16 of 18

Computed By HEU

Checked By TS

Date 4/20/79

Field Book Ref _____

Other Refs CE # 27-595-KB

Revisions _____

HAITFORD RESERVOIR N86 DAMS

1.2 (cont'd) BREACH WIDTH

iii) BREACH WIDTH (SEE NED-ACE $\frac{1}{2}$ DAM FAILURE GUIDELINES)

$$W = 0.4 \times 480 = 192' \quad \text{ASSUME } W_b = 190'$$

b) PEAK FAILURE OUTFLOW (Q_p)

ASSUME SURCHARGE TO TOP OF EMBANKMENT, ELEV. 405.4' MSL \approx 407.5' MDD
BECAUSE, ALTHOUGH THE DAM IS NOT OVERTOPPED AT TEST FLOOD (11.1' FREEBOARD),
THIS SURCH. MAY BE POSSIBLE IN CASE OF OBSTRUCTION AT THE SPILLWAY/CONDUIT SYSTEM

i) HEIGHT AT TIME OF FAILURE: $Y_0 \approx 42'$

ii) SPILLWAY/CONDUIT DISCHARGE $Q_{sk} = 2560 \text{ CFS}$

iii) BREACH OUTFLOW (Q_b): $Q_b = \frac{8}{27} W_b \sqrt{Y_0} Y_0^{3/2} = 86950 \text{ CFS}$

iv) PEAK FAILURE OUTFLOW (Q_p): $Q_p = Q_{sk} + Q_b = 89500 \text{ CFS}$

c) FLOOD STAGE IMMEDIATELY $\frac{1}{2}$ FROM DAM:

$$Y \approx 0.44 Y_0 \approx 18'$$

2) ESTIMATE OF $\frac{1}{2}$ DAM FAILURE CONDITIONS AT IMPACT AREA

(SEE NED-ACE GUIDELINES FOR ESTIMATING $\frac{1}{2}$ DAM FAILURE HYDROGRAPH)

ASSUME RESERVOIR FULL TO TOP OF EMBANKMENT AT TIME OF FAILURE

a) RESERVOIR STORAGE AT TIME OF FAILURE: $S \approx 3500 \text{ AC} \cdot \text{FT}$ (SEE P. 2)
 $S/2 \approx 1750 \text{ AC} \cdot \text{FT}$

D-16

Cahn Engineers Inc.

Consulting Engineers

Project NON-FEDERAL DAMS INSPECTION
Computed By HU Checked By TS
Field Book Ref _____ Other Refs. CE #37-591-KB

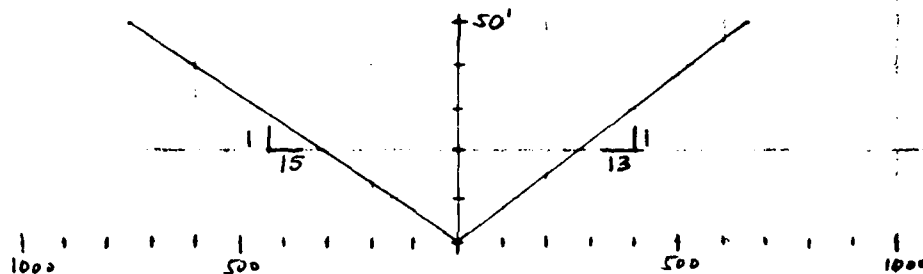
Sheet 17 of 18
Date 4/20/79
Revisions _____

HARTFORD RESERVOIR NO. 6 DAMS

2-Cont'd) DAM FAILURE CONDITIONS AT IMPACT AREA

b) TYPICAL $\frac{P}{L}$ CROSS SECTION & RATING CURVES

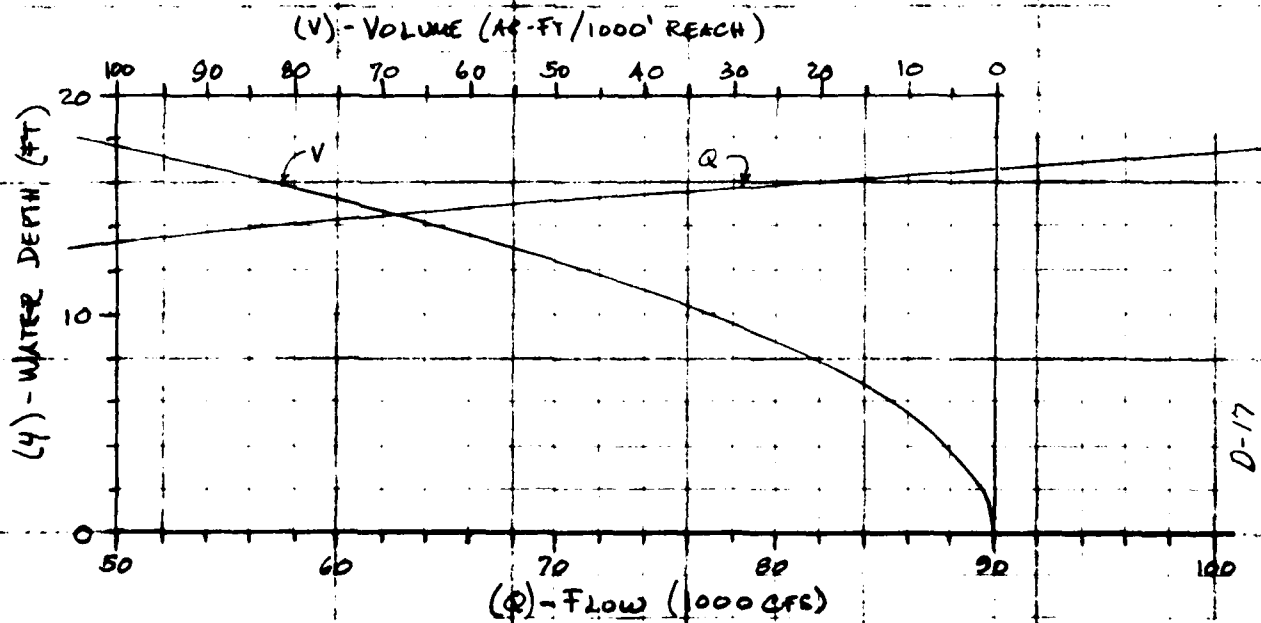
(FROM USGS. AVON, CT., QUADRANGLE SHEET PART REV. 1968, SCALE 1:20000)



ASSUME: i) $M=0.050$

ii) SLOPE: $S_{0.2} = 3.7\%$ (DROPS 100' IN (±) 2700')

c) RATING CURVES



Object NON-FEDERAL DAMS INSPECTION
 Computed By HU Checked By TS
 Field Book Ref _____ Other Refs CE # 37-595-KB

Sheet 18 of 18
 Date 4/23/79
 Revisions _____

HARTFORD RESERVOIR NO 6 DAMS

2-Cont'd) D/S DAM FAILURE CONDITIONS AT IMPACT AREA

d) REACH OUTFLOW (Q_R)

i) ASSUME REACH LENGTH $L_R = 4000'$ (RES. NO 6 TO DOWN AREA OF N. HARTFORD)

ii) @ $Q_P = 89500$ CFS : $y_1 = 16.5'$: $V_1 = 351$ ACFT

iii) $Q_R = Q_P \left(1 - \frac{V_1}{5}\right) = 80500$ CFS : $y_2 = 15.9'$: $V_2 = 325$ ACFT

iv) AVE VOLUME IN REACH : $V_{Ave} = 338$ ACFT

v) : $Q_R = 80900$ CFS : $y_3 = 15.9'$ (AT IMPACT AREA)

e) APPROXIMATE STAGE JUST BEFORE FAILURE:

$Q = Q_{SK} = 2560$ CFS : $y_{SK} = 4.4'$

f) RAISE IN STAGE AFTER FAILURE : $\Delta y = 11.5'$ (AT IMPACT AREA)

3) SUMMARY:

a) PEAK FAILURE OUTFLOW : $Q_P = 89500$ CFS

b) REACH OUTFLOW : $Q_R = 80900$ CFS

c) FLOOD DEPTH IMMEDIATELY RI FROM DAM : $y = 18'$

d) APPROXIMATE STAGE AT IMPACT AREA JUST BEFORE FAILURE : $y_{SK} = 4.4'$

e) APPROXIMATE STAGE AT IMPACT AREA AFTER FAILURE : $y_3 = 15.9'$

f) RAISE IN STAGE AT IMPACT AREA AFTER FAILURE : $\Delta y = 11.5'$

PRELIMINARY GUIDANCE
FOR ESTIMATING
MAXIMUM PROBABLE DISCHARGES
IN
PHASE I DAM SAFETY
INVESTIGATIONS

New England Division
Corps of Engineers

March 1978

MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

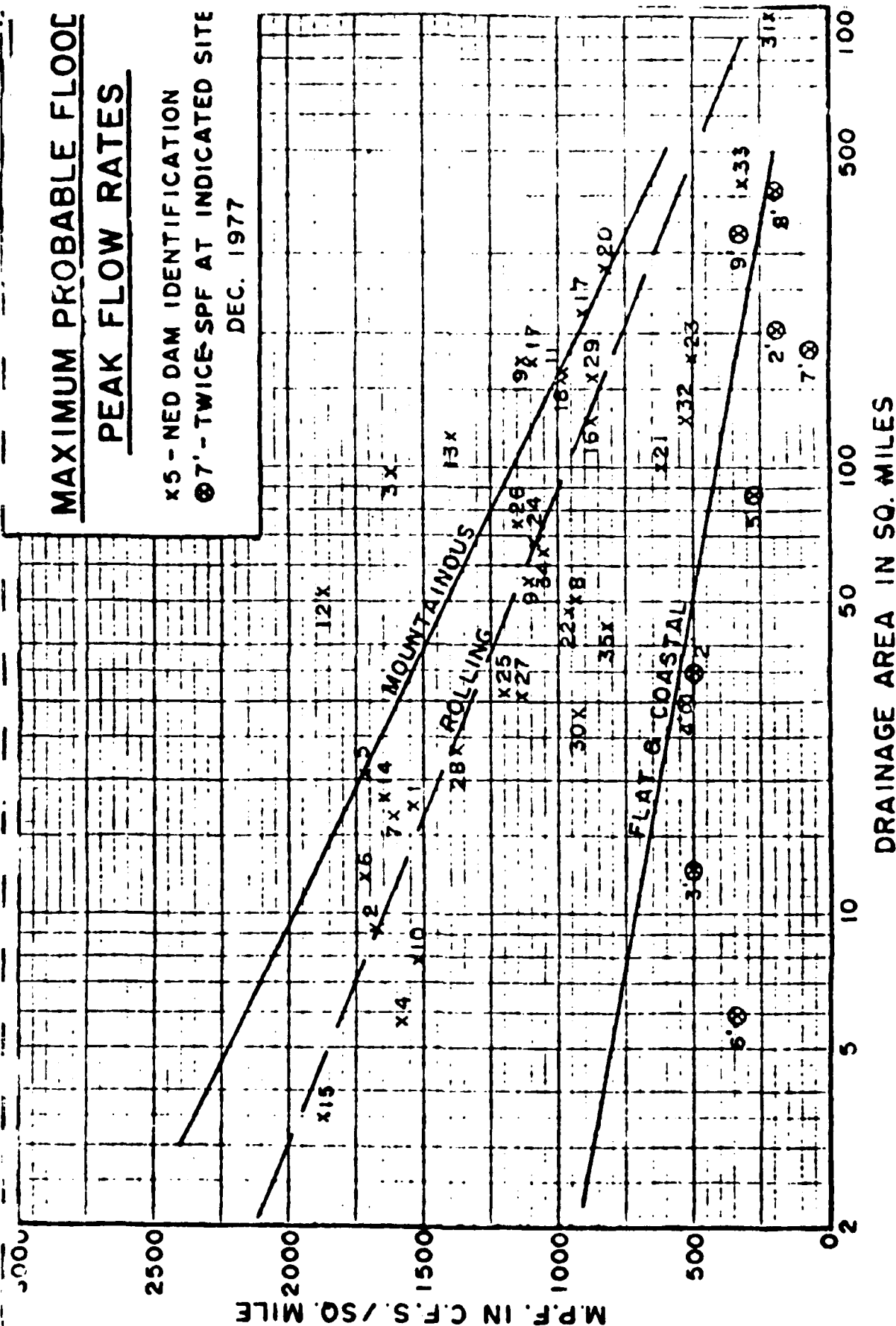
<u>Project</u>	<u>Q</u> (cfs)	<u>D.A.</u> (sq. mi.)	<u>MPF</u> cfs/sq. mi.
1. Hall Meadow Brook	26,600	17.2	1,546
2. East Branch	15,500	9.25	1,675
3. Thomaston	158,000	97.2	1,625
4. Northfield Brook	9,000	5.7	1,580
5. Black Rock	35,000	20.4	1,715
6. Hancock Brook	20,700	12.0	1,725
7. Hop Brook	26,400	16.4	1,610
8. Tully	47,000	50.0	940
9. Barre Falls	61,000	55.0	1,109
10. Conant Brook	11,900	7.8	1,525
11. Knightville	160,000	162.0	987
12. Littleville	98,000	52.3	1,870
13. Colebrook River	165,000	118.0	1,400
14. Mad River	30,000	18.2	1,650
15. Sucker Brook	6,500	3.43	1,895
16. Union Village	110,000	126.0	873
17. North Hartland	199,000	220.0	904
18. North Springfield	157,000	158.0	994
19. Ball Mountain	190,000	172.0	1,105
20. Townshend	228,000	106.0(278 total)	820
21. Surry Mountain	63,000	100.0	630
22. Otter Brook	45,000	47.0	957
23. Birch Hill	88,500	175.0	505
24. East Brimfield	73,900	67.5	1,095
25. Westville	38,400	99.5(32 net)	1,200
26. West Thompson	85,000	173.5(74 net)	1,150
27. Hodges Village	35,600	31.1	1,145
28. Buffumville	36,500	26.5	1,377
29. Mansfield Hollow	125,000	159.0	786
30. West Hill	26,000	28.0	928
31. Franklin Falls	210,000	1000.0	210
32. Blackwater	66,500	128.0	520
33. Hopkinton	135,000	426.0	316
34. Everett	68,000	64.0	1,062
35. MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS
BASED ON TWICE THE
STANDARD PROJECT FLOOD
(Flat and Coastal Areas)

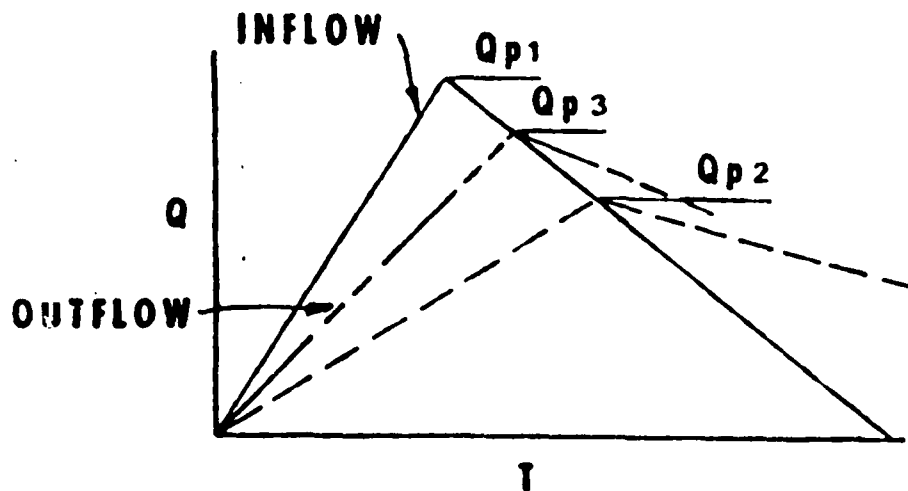
<u>River</u>	<u>SPF</u> (cfs)	<u>D.A.</u> (sq. mi.)	<u>MPF</u> (cfs/sq. mi.)
1. Pawtuxet River	19,000	200	190
2. Mill River (R.I.)	8,500	34	500
3. Peters River (R.I.)	3,200	13	490
4. Kettle Brook	8,000	30	530
5. Sudbury River.	11,700	86	270
6. Indian Brook (Hopk.)	1,000	5.9	340
7. Charles River.	6,000	184	65
8. Blackstone River.	43,000	416	200
9. Quinebaug River	55,000	331	330

MAXIMUM PROBABLE FLOOD PEAK FLOW RATES

x5 - NED DAM IDENTIFICATION
 ⊗ 7' - TWICE-SPF AT INDICATED SITE
 DEC. 1977



ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Q_{p1}) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass " Q_{p1} ".

b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and " $STOR_2$ " To Pass " Q_{p2} "

b. Average " $STOR_1$ " and " $STOR_2$ " and Determine Average Surcharge and Resulting Peak Outflow " Q_{p3} ".

SURCHARGE STORAGE ROUTING SUPPLEMENT

**STEP 3: a. Determine Surcharge Height and
"STOR₂" To Pass "Q_{p2}"**

**b. Avg "STOR₁" and "STOR₂" and
Compute "Q_{p3}".**

**c. If Surcharge Height for Q_{p3} and
"STOR_{avg}" agree O.K. If Not:**

**STEP 4: a. Determine Surcharge Height and
"STOR₃" To Pass "Q_{p3}"**

**b. Avg. "Old STOR_{avg}" and "STOR₃"
and Compute "Q_{p4}"**

**c. Surcharge Height for Q_{p4} and
"New STOR_{avg}" should Agree
closely**

SURCHARGE STORAGE ROUTING ALTERNATE

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{\text{STOR}}{19} \right)$$

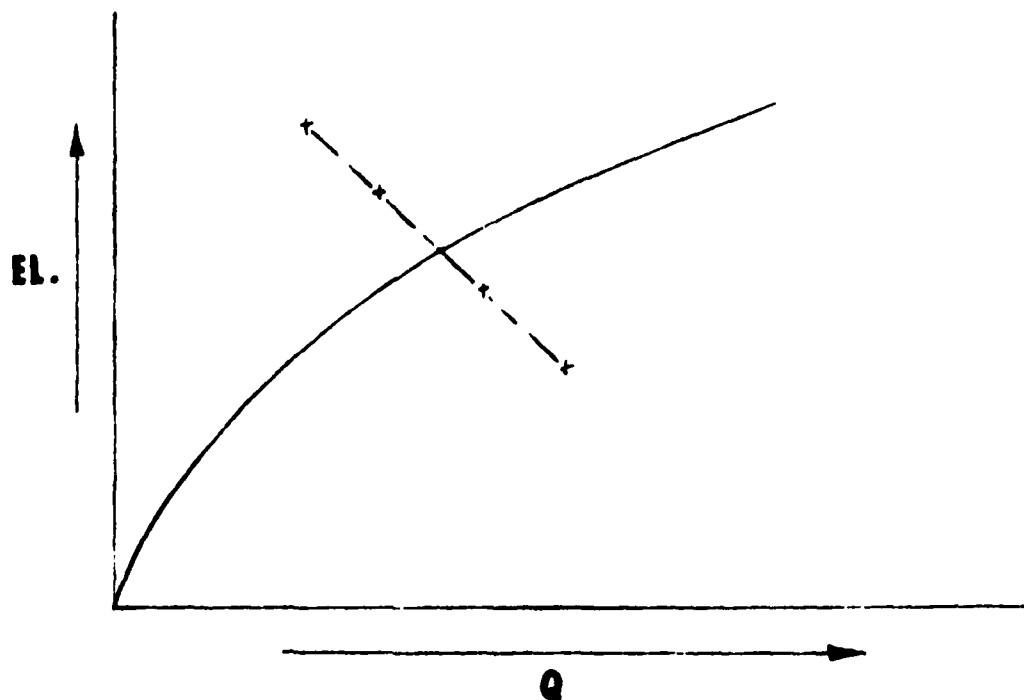
$$Q_{p2} = Q_{p1} - Q_{p1} \left(\frac{\text{STOR}}{19} \right)$$

FOR KNOWN Q_{p1} AND 19" R.O.

Q_{p2}
=====

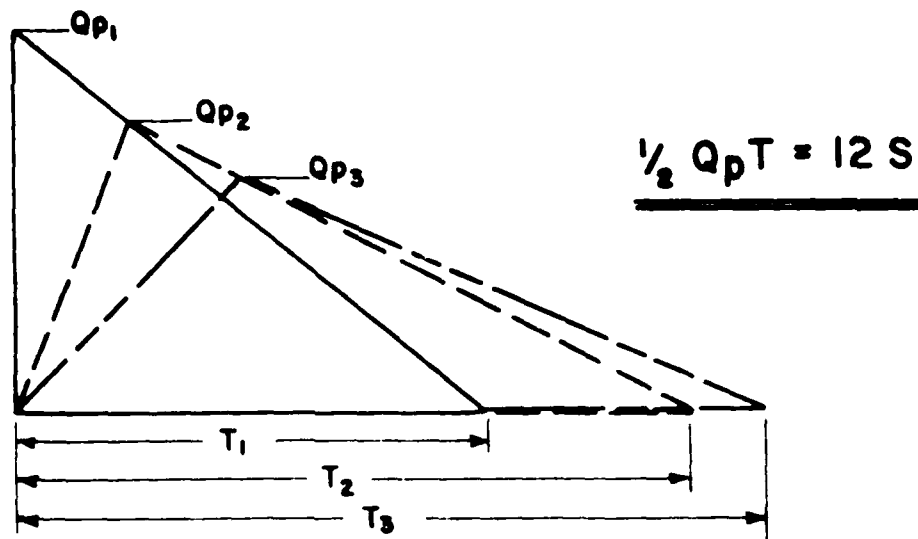
STOR
=====

EL.
=====



Q

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Q_{p1} = \frac{8}{27} W_b \sqrt{g} Y_0^{3/2}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_0 = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

- A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOMPANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS $1/2$ OF S, SELECT SHORTER REACH.)
- B. DETERMINE TRIAL Q_{p2} .

$$Q_{p2}(\text{TRIAL}) = Q_{p1} \left(1 - \frac{V_1}{S}\right)$$
- C. COMPUTE V_2 USING Q_{p2} (TRIAL).
- D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2} .

$$Q_{p2} = Q_{p1} \left(1 - \frac{V_{\text{avg}}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E

INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS



INVENTORY OF DAMS IN THE UNITED STATES

IDENTITY NUMBER	STATE	DIVISION	COUNTY	CORNER	NAME	REPORT DATE
5	MD	CT	003	01	HARTFORD RESERVOIR SIX EAST DAM	4148.2 7246.9 01JUN79

POPULAR NAME	NAME OF IMPROVEMENT
	HARTFORD RESERVOIR SIX

REGION	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 00	TH-TUMBLE BROOK	WEST HARTFORD	2	68031

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STATUS	HYDRAULIC HEIGHT	MAXIMUM	ROUTING CAPACITIES	DIST U.S. NED	VER/DATE
REPORT	1905	S	42	42	300	2400	N	N

REMARKS
20-ESTIMATE 22-MAISED 3 FT IN 1964 21-INCH CONCRETE CURB WALL
D/S HAS SPILLWAY MAXIMUM DISCHARGE (FT.) VOLUME OF DAM (CY) PIWER CAPACITY INSTALLED PROPOSED NO. OF PILES LENGTH OF PILES
1 3500 U 50 2540

OWNER	ENGINEERING BY	CONSTRUCTION BY
METROPOLITAN DISTRICT		

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
CT WATER RESOURCES	CT WATER RESOURCES	CT WATER RESOURCES	CT WATER RESOURCES

INSPECTION BY	INSPECTION DATE	AUTHORITY FOR INSPECTION
CAMP ENGINEERS INC	04-1-79	PUBLIC LAW 92-507 AUG 1972

REMARKS

DATE
ILME